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METAL FINISHING

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FOUNDED 1903

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Surface Treatment and Finishing
of Light Metals *Copy*
Hard Anodizing

Maize Cellulose as a Finishing Material
Its Uses in Tumbling and Drying

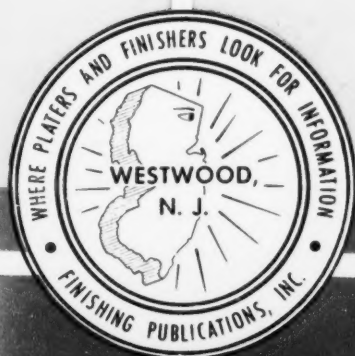
Stress in Electrodeposited Coatings
Its Significance and Measurement

Analysis of Electroplating Solutions
Boric Acid Determination

Finishing Pointers
Adjustment of Bath Voltage by Fixed Resistance

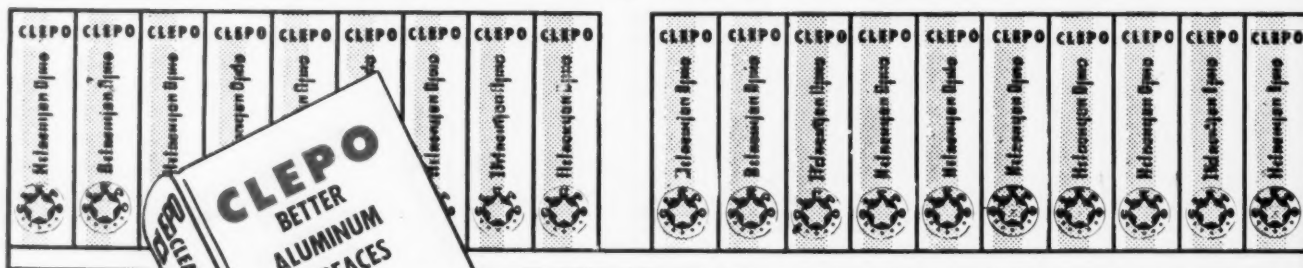
Science for Electroplaters
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Complete Contents Page 49



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SOAK CLEANER	CLEPO 86-P, mild for general use
SPRAY CLEANER	CLEPO 85-AN, for wash machines
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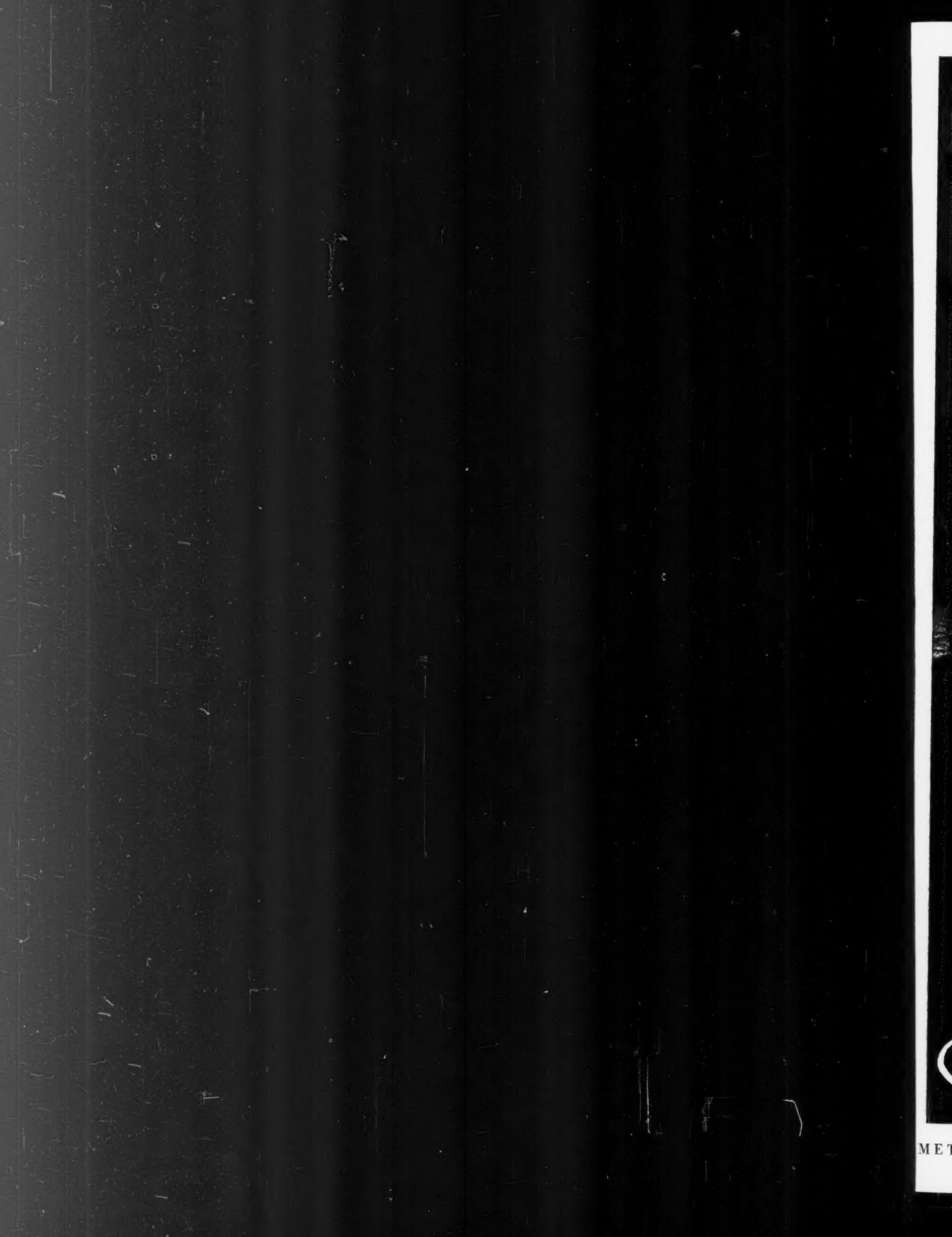
CLEPO Field Men have a thorough understanding of anodizing operations and of surface preparation problems in connection with anodizing. By all means call on them for service. And, as is implied by the above partial list of CLEPO Products, they have many formulations from which to select to take care of your specific requirements.

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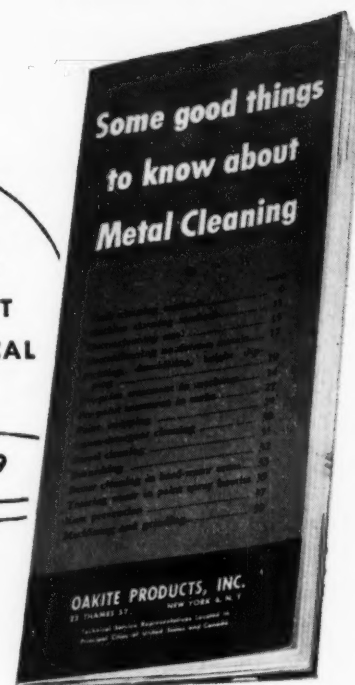
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You'll want to know the answers

Can one cleaning material do all metal-cleaning jobs? *See page 5.*

What kind of cleaner attracts both oil and water? How does this help remove buffing compound residues and pigmented drawing compounds? *See page 8.*

Why clean ferrous and nonferrous metals in separate tanks? *See page 10.*

What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For electrocleaning nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page 17.*

Can you electroclean brass without tarnishing? *See page 18.*

How do bright dips make metals brighter? *See page 21.*

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet? *See page 24.*

Would you like a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 28.*

What's the best way to clean parts that are too large to be soaked in tanks or conveyed through washing machines? *See page 30.*

Does your burnishing barrel produce a luster you are proud of? *See page 32.*

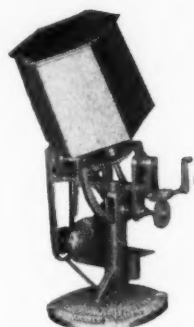
What do you do when the overspray neither sinks nor floats in the wash water in your paint spray booth? *See page 35.*

Do you dry steel parts before anti-rusting? *See page 37.*

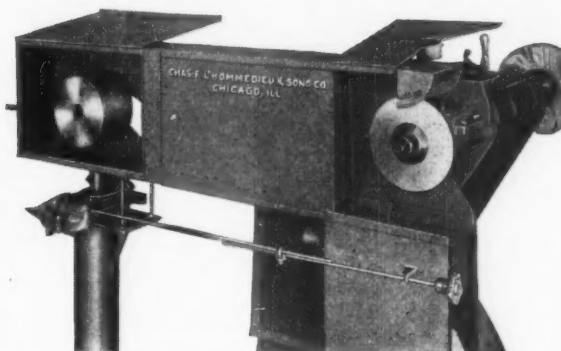
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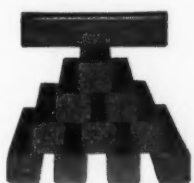
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TUMBLING BARREL



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#23A
POLISHING LATHE



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STANDARD SIZE
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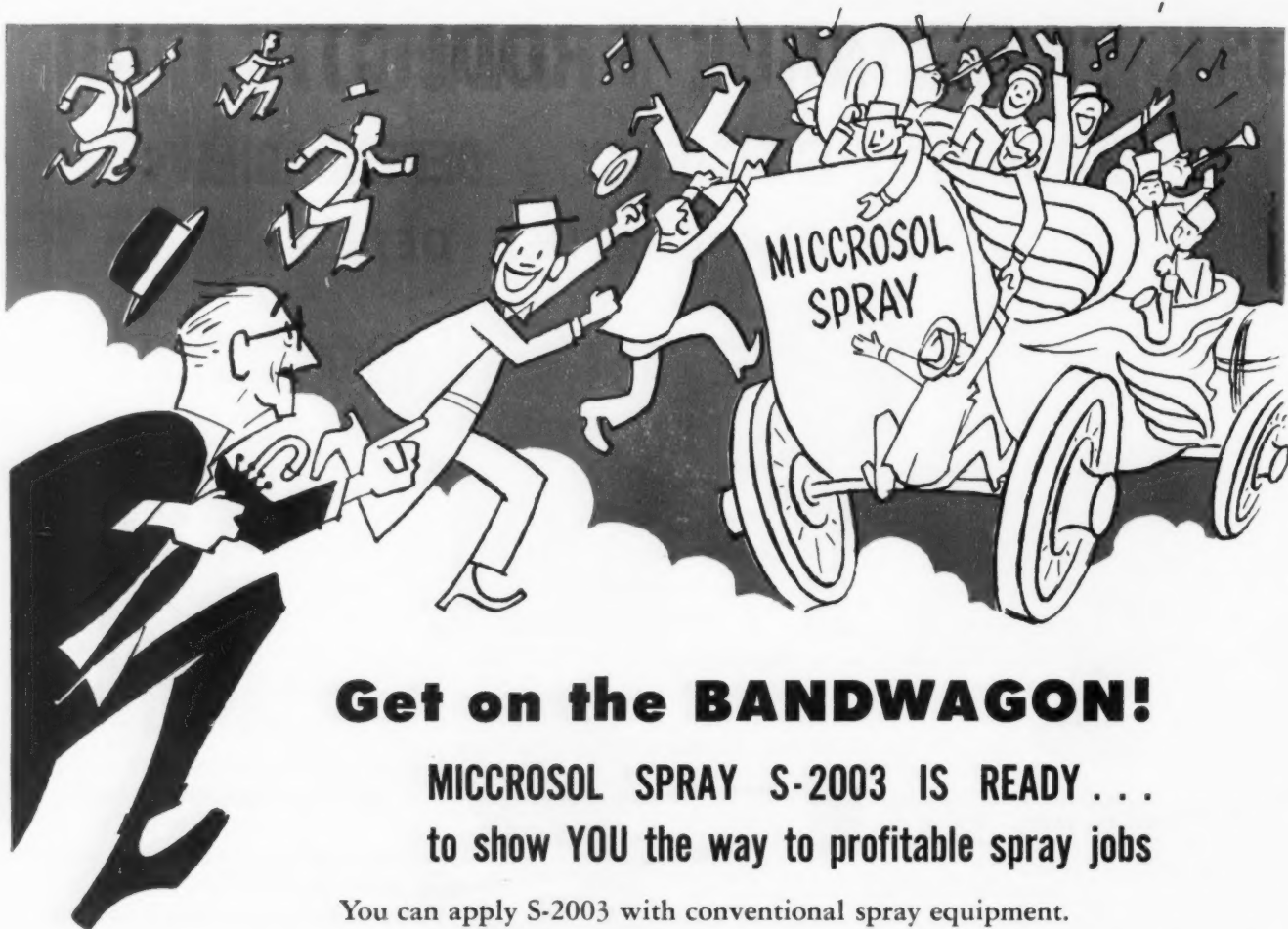
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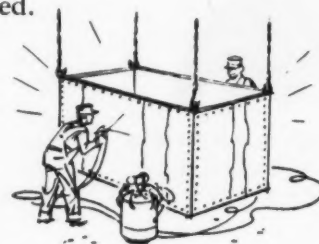
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It's the ideal plastisol for spray applications.

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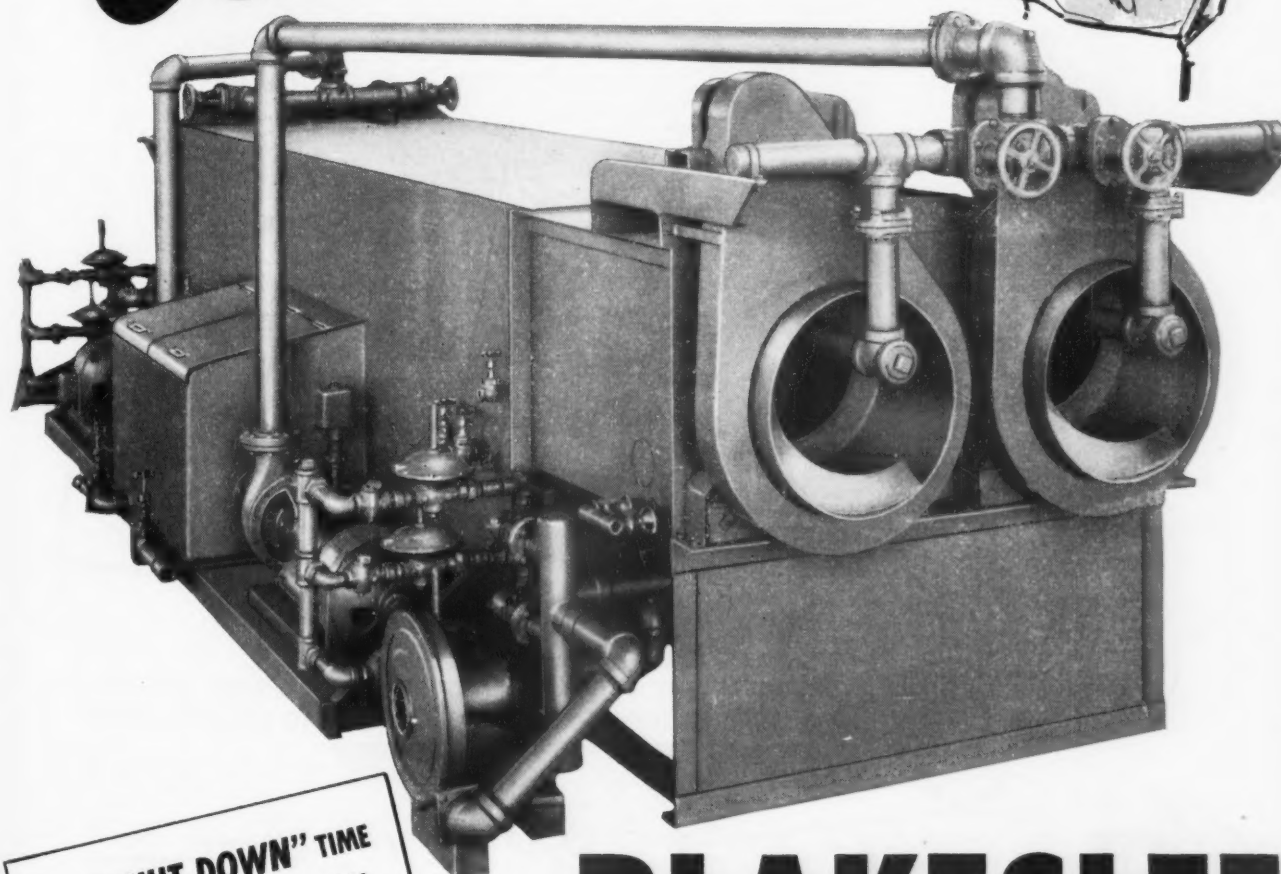
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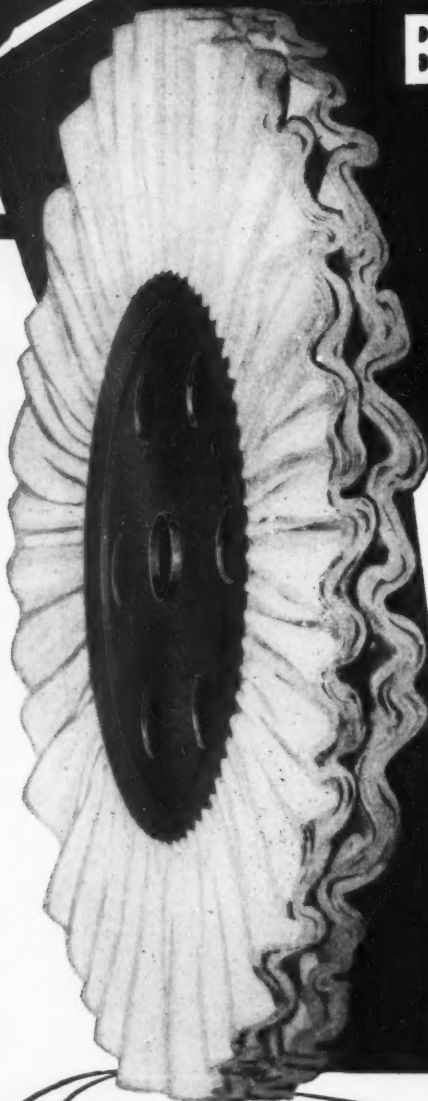
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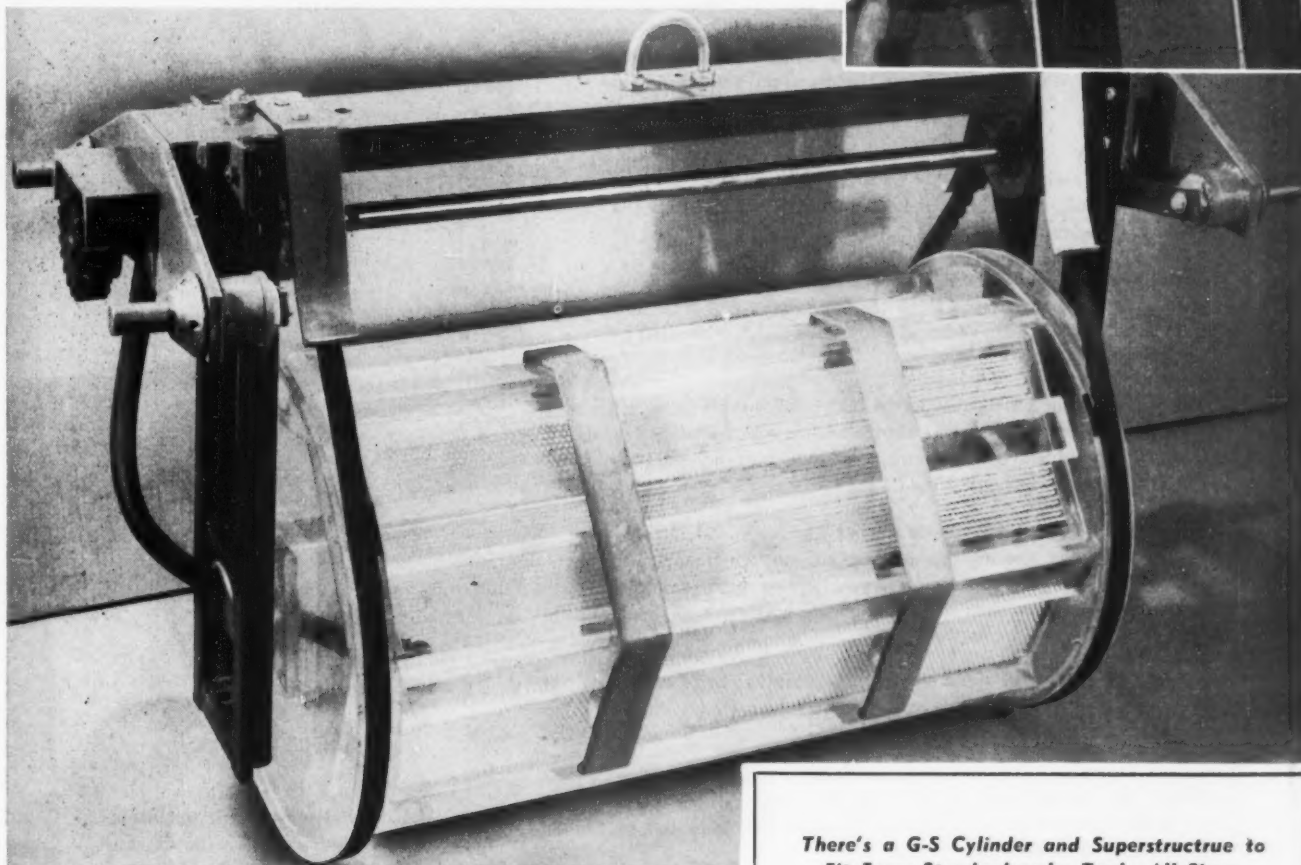
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(top inset) Close-up of "Cogged-V-Belt" Drive.
(left) Gill-Singleton GSU 14 x 30 cylinder and superstructure for competitive tank.

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What's more, only superior quality components are found in RAPID rectifiers.

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Selenium Type Unit — Available with RAPID'S control quality, long life Selenium plates which are coated with a special protective compound.

Transformer — Specifications encompass class B design, with KVA ratings standardized at 33% to 40% above the total d.c. output wattage. Corrosion-resistant protective finishes applied to all transformers.

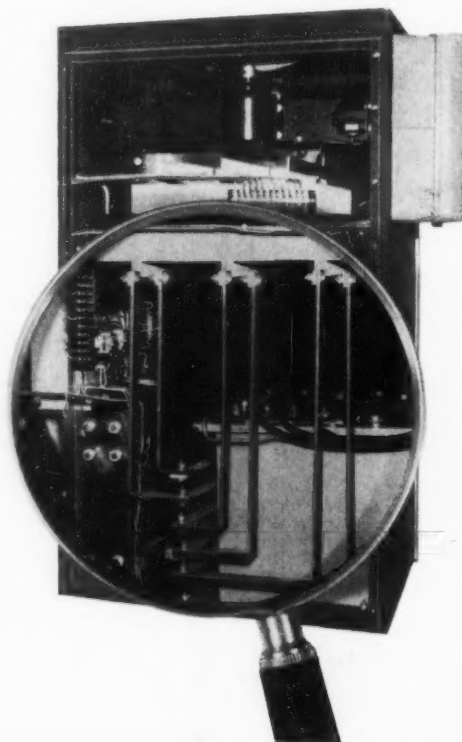
Controls — Rapid INDUCTROL provides fully-motorized oil immersed, continuously variable control. Close control of power output is accomplished by depressing two buttons, varying power from zero to full rated load.

Copper Output Bus — All copper output bus bars, and interior copper conductors are designed with an amperage carrying capacity of no less than 1000 amperes per square inch. An anti-corrosive compound is used to safeguard the entire length from corrosion.

Fan Motors — Forced-air cooled units employ ball-bearing motors of the self-lubricating type. Excessive wear and costly maintenance is thereby reduced.

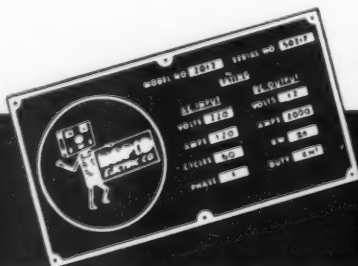
Magnetic Starters — All starters used on three-phase units have an ample current-carrying capacity well above the ratings specified. Quality starters of reputable manufacture are job-rated to rectifier input specifications.

Meters — First-line, quality meters, have an accuracy of 2%, and are standard equipment on all RAPID models. By an exclusive patented process, Rapid manufactures its meter-shunts with an accuracy of $\frac{1}{2}\%$ over a temperature range of 0.180°C. Designed with a low temperature coefficient, a high heat dissipation is the result. Calibration remains constant under extreme shock or stress, due to its unusual mechanical strength and stability.



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A Timely Message on Automation

by Ben P. Sax

President, American Buff Company

It seems a safe prediction that, one day, automation will be an everyday routine in our lives. We'll have to rack our memories—twenty-five or fifty years from now—just to recall what all the shouting was about. And I am confident we will be rather amused at the suspicion which automation initially aroused in some quarters.

Eventually, the "spectre" of automation will be likened to the first threat of steam power.

If I recall my economic history correctly, the Industrial Revolution of the early 1800's was a truly disrupting process. And, aside from the economic adjustments required, people were really frightened by the steaming, smoking mechanical monsters it spawned.

However, the seeming "monsters" soon proved to be quite gentle. And power driven machines—steam, electric, gasoline and oil—became amazingly beneficial, collectively and individually. Child labor disappeared. The working day became much shorter. Wages went up. And, with increasing production, prices went down as overall sales volume went up.

Fortunately for our young country, the Industrial Revolution proved to be the vehicle (together with the "Horseless Carriage") for the American way of life and the American system of free enterprise.

With this steady and impressive "pilot operation" to look back on, I look forward with keen interest to the use of automation in industry. The resulting "revolution" will undoubtedly be smoother, more gradual than the introduction of machines at the start of the century. Most important, automation could well be another great advance for our American way of life . . . and for the world.

Sincerely,

Ben P. Sax



"For the job that's TOUGH—use an AMERICAN BUFF"

American Buff Company

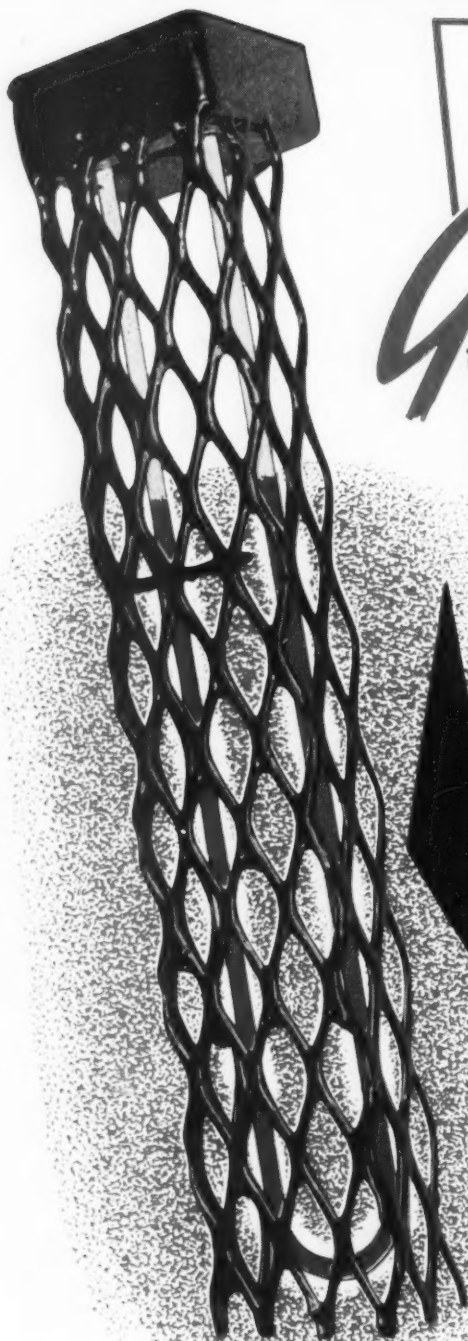
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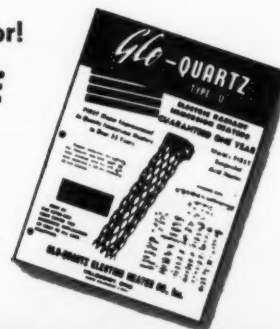
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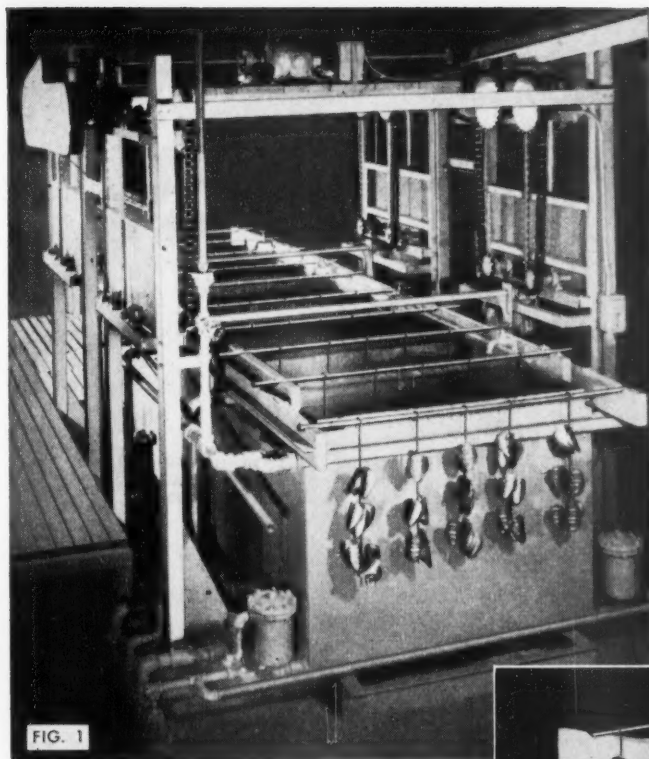


FIG. 1

Fig. 1. Loading End. Loaded racks are hung on rod placed in saddles on transfer frame. At end of each processing period the machine automatically lifts all rods and advances each one tank in the processing cycle.

Fig. 2. Delivery End. Picture shows transfer frame elevated in the transfer operation. When the frame comes down the last rod, which carries parts from the last tank in the processing cycle, will be placed in the unloading saddles on the frame which extends beyond the last tank.

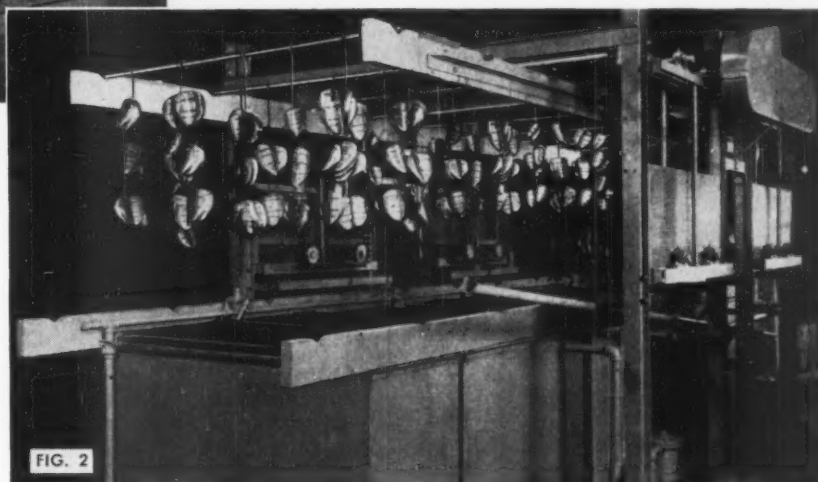


FIG. 2

Features

- Affords practically any required cycle for plating, painting, etching, etc.
- Flexible. Easily adjusted to "skip" tanks for processing articles of different basic metals without changing solution.
- Automatic Timing. Easily set for any processing period from 10 seconds to 20 minutes.
- Uniform Processing. The automatic timer doesn't forget—is not called away. Spoilage is avoided.
- Helps Foreman maintain full production. At a glance he can see partially loaded rods or empty saddles—then locate the cause.
- Available with conveyor-equipped plating tank to which processed work is automatically transferred.

The BELKE Automatic Transfer Machine stops the backaches and high labor costs of processing parts for plating.

The machine automatically lifts and transfers work from tank to tank through the entire pre-plating cycle such as electrocleaning, tepid running rinse, anodic electroclean, cold running rinse, acid bath, cold running rinse, cyanide bath, cold running rinse. Practically any cycle can be had.

The Transfer Unit can be adjusted to "skip" tanks as desired for processing articles of different metals such as steel, brass and die castings. This flexibility makes practical automatic processing of a great range of varied work.

For further labor-saving, a conveyor-equipped plating tank can be furnished with the BELKE Transfer Unit. The Transfer Unit automatically transfers processed work to the conveyor and the work is completely plated while moving through the plating tank.

Send for literature or see your BELKE Service Engineer.

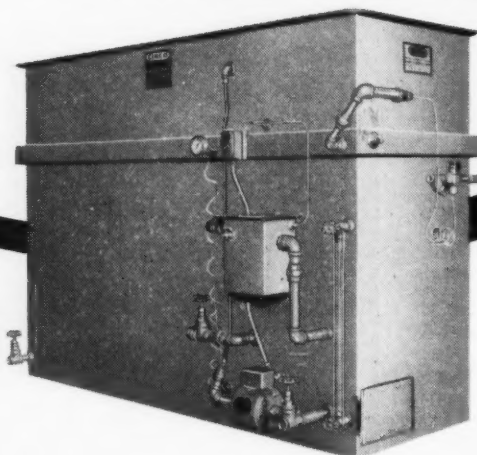


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rotor and end plates are nickel clad. The new Circo pump, without stuffing box, rotary seals, coupling drive sheaves, or V belts, uses a rotating magnetic field to drive the impeller, and is virtually foolproof. It's safely sealed—leaking is impossible.

DEMAND TYPE WATER CONTROL A water temperature regulator to accurately control water in the coil and insure a 90° to 120° F. temperature for water entering the water jacket, eliminates water condensation which would result in hydrolysis, rusting and acid solvent.

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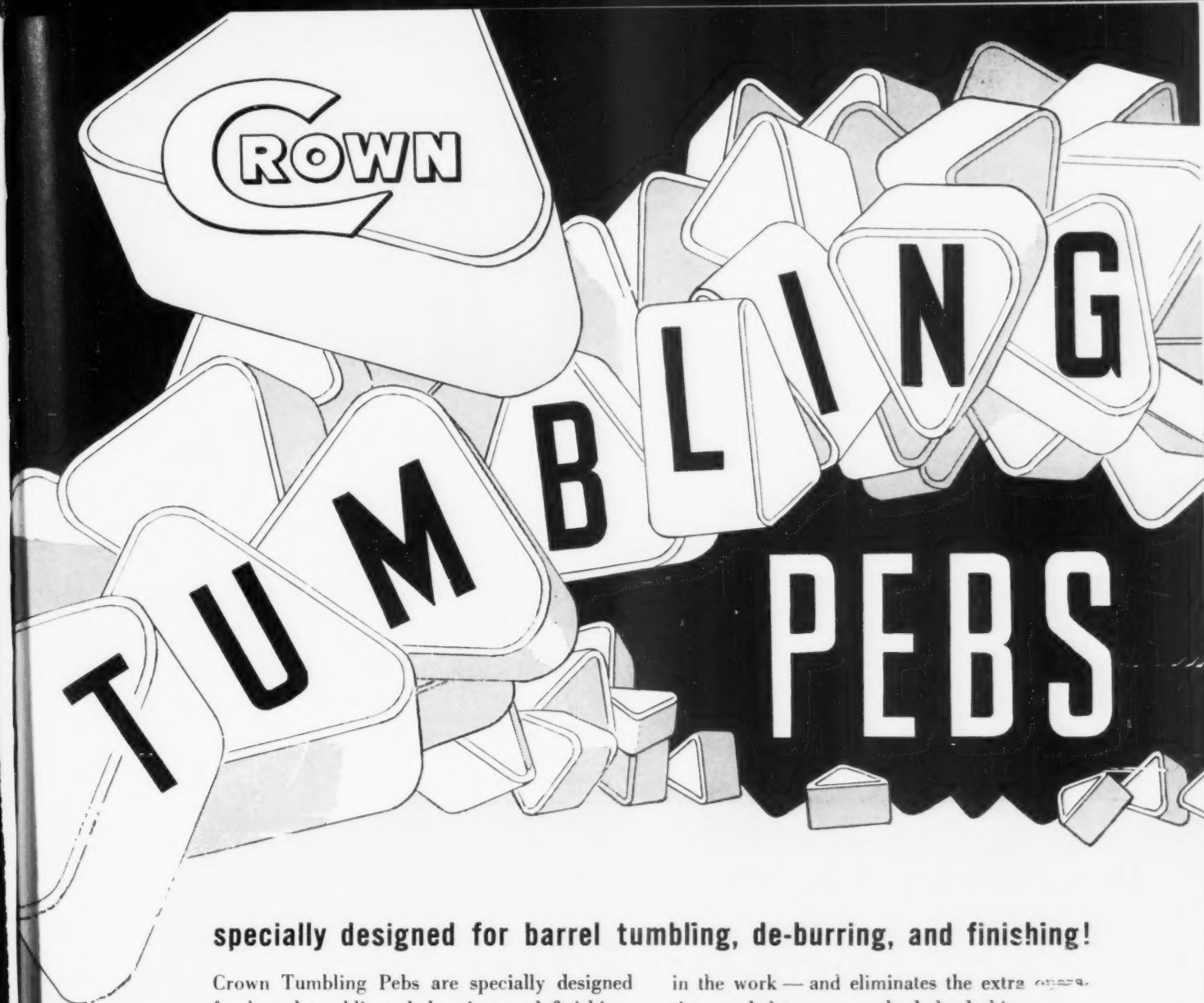
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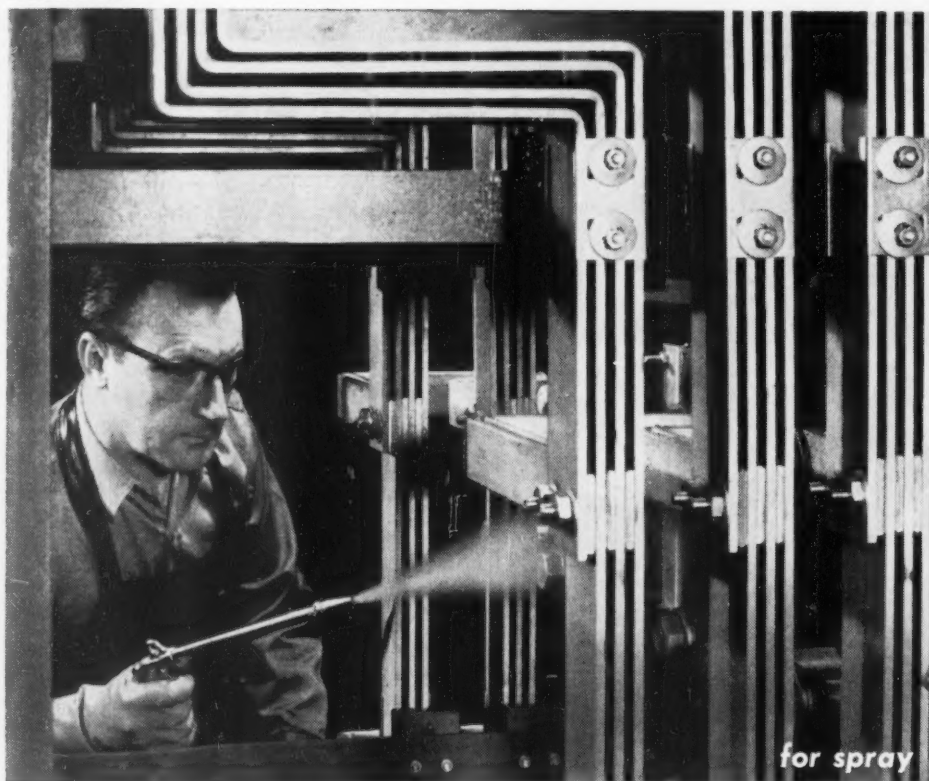
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☐ WF-3NS (dry type) ☐ WF-11NS (greasy type)
☐ WF-7NS (medium type) ☐ WF-17NS (very greasy type)

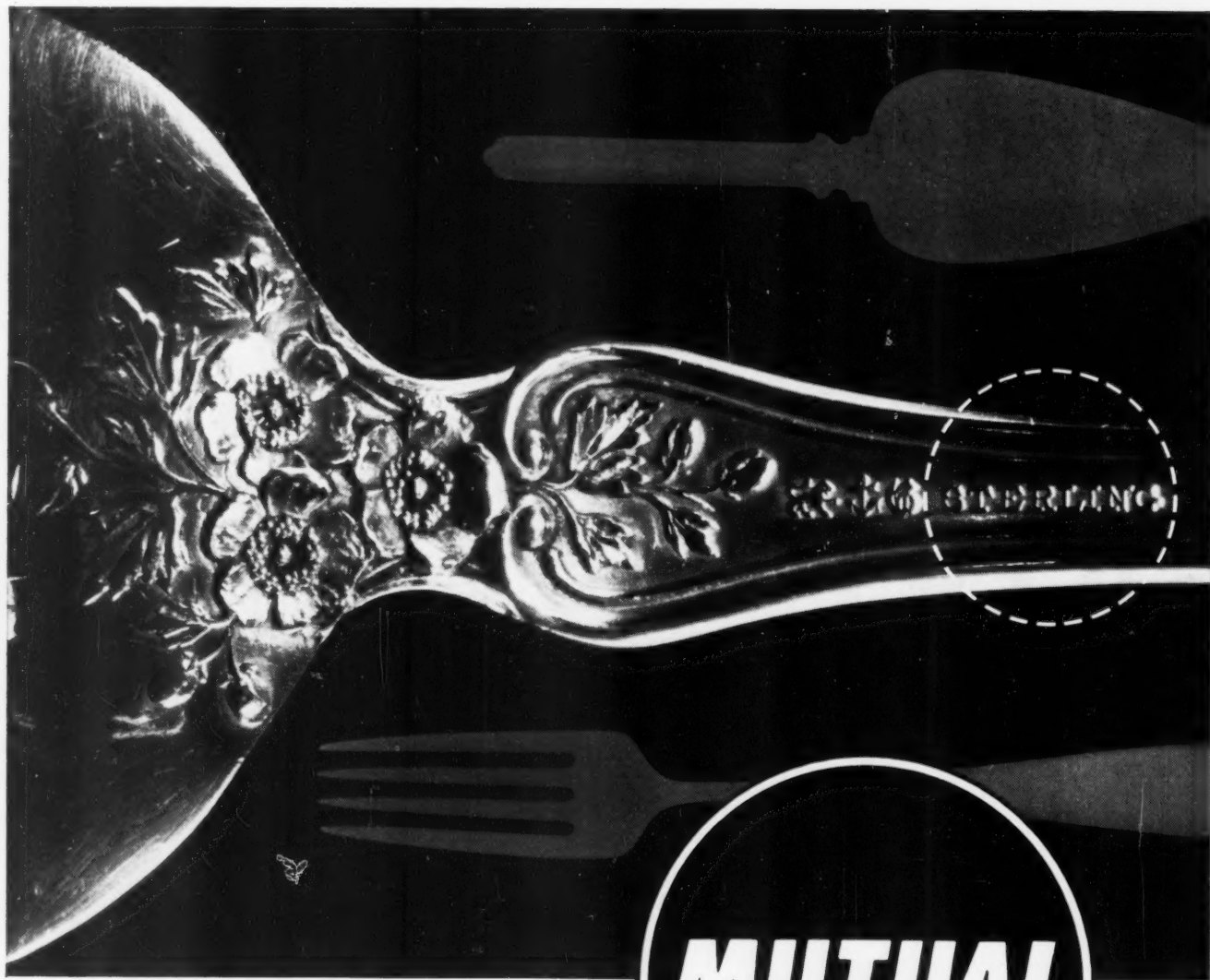
☐ Other Peerless Compound _____
for _____ (application) on
_____ plate or metal.

Firm Name _____

Address _____

City _____ State _____

Telephone _____



“Symbols

YOU CAN RELY ON”

The word ‘sterling’ means the best in quality silverware the world over. In fact, this word is the trade mark demanded by discerning people wherever fine silver is examined.

Likewise, users of Chromium Chemicals know exactly what our trade mark means. The word Mutual on any container of Chromium Chemicals stands not only for guaranteed top purity of the product itself, but also for the outstanding reputation of the Company. When you are in the market for Chromium Chemicals, look for the name Mutual, a symbol for quality.

Chromic Acid • Sodium Bichromate • Potassium Bichromate



MUTUAL CHEMICAL DIVISION

— ALLIED CHEMICAL & DYE CORPORATION —

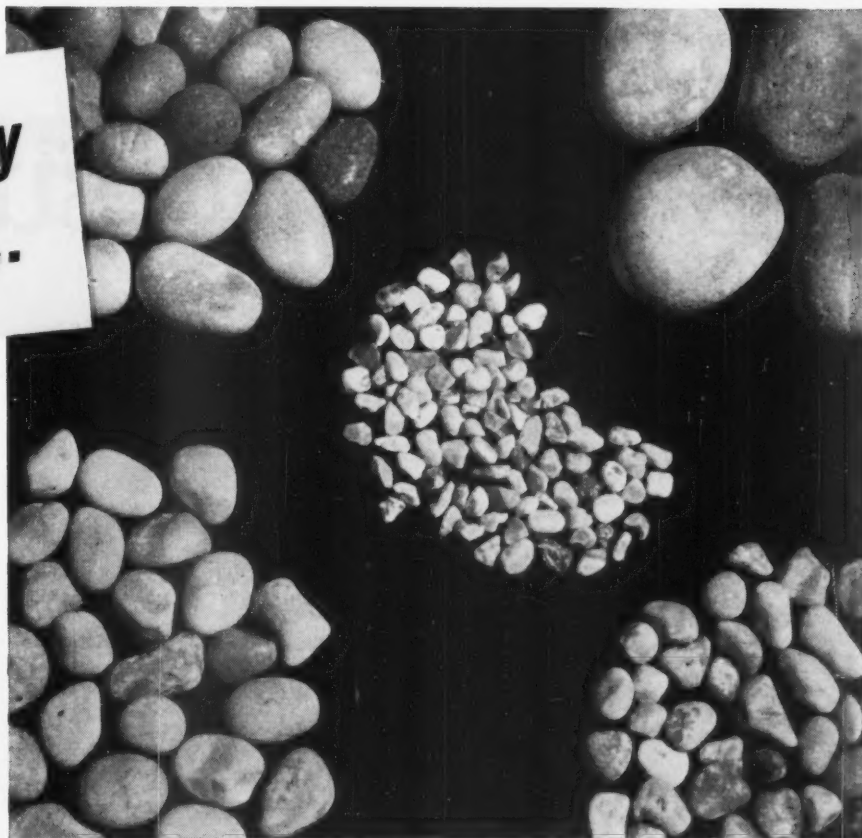
99 PARK AVENUE • NEW YORK 16, N. Y.



**Processed only
by nature!...**

**Offered
only by
Norton!...**

NEW



A "natural" for many barrel-finishing applications. The new Tumblex "N" abrasive, offered exclusively by Norton comes in sizes ranging from $\frac{3}{16}$ " by $\frac{3}{8}$ " to $1\frac{3}{8}$ " by $2\frac{1}{2}$ ".

TUMBLEX "N" TUMBLING ABRASIVE

*Natural abrasive brings value-adding, cost-cutting
"TOUCH of GOLD" advantages to barrel-finishing*

Tumblex "N" Abrasive is Nature's own tumbling abrasive. Carefully selected and graded by Norton, it opens up new possibilities for barrel-finishing applications such as light deburring, breaking sharp edges, polishing and burnishing and other operations where little actual cut is required. It is especially suited for work on die castings.

Tumblex "N" has proved particularly valuable in bringing out the most desirable color of the finished part. Metals on which it has proved its ability to give an excellent finish include zinc, brass, copper, aluminum and various forms of steel, including stainless.

Its rounded, uniform shape and very low breakdown ratio permit longer cycles and reduce the need of rescreening.

Another big Tumblex "N" advantage is extremely uniform cutting action. This assures the same uniform finishing in load after load. Also, it enables close

regulation of cut; for example, by adding measured quantities of loose abrasive grain to Tumblex "N" you can speed up the rate of cut with little effect on the life of this natural abrasive. Exact formulas for best results in job or production tumbling are easily worked out.

Norton customers who have tested Tumblex "N" Abrasive report:

- "Very good luster with no noticeable wear."
- "Fine performance. Very little breakdown. Reordering 700 pounds of sizes $2\frac{1}{2}$ T and $3\frac{1}{2}$ T."
- "Color O.K. on both zinc and brass."
- "Very long life. Gave excellent color on stainless steel."
- "A good polishing stone on aluminum."

Send Your Work Samples

Let us demonstrate in our newly enlarged Sample Processing Department how Tumblex "N" Abrasive can give the

value-adding "Touch of Gold" to your product quality and cut your barrel-finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Export: Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. G-303



*Making better products...
to make your products better*

NORTON COMPANY
Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING Division
Coated Abrasives • Sharpening Stones
Pressure-Sensitive Tapes

There is no substitute

...in original equipment...or for replacement

INSIST ON INTERNATIONAL RECTIFIER STACKS!

**The life and efficiency of your plating equipment
depends upon one vital component—the power rectifier!**

HERE ARE FOUR REASONS WHY YOU SHOULD INSIST ON INTERNATIONAL RECTIFIERS...

1 UNSURPASSED QUALITY BACKED BY EXPERIENCE

International Rectifier Corporation is the world's largest supplier of metallic rectifiers. Over 2,000,000 KW of power are converted daily for plating and metal finishing by International Selenium and Germanium power units. This fact, plus the knowledge that International Rectifier Corporation supplies more than half of all metallic rectifiers installed in industrial equipment, attests to the wealth of experience and know-how behind every unit produced. All units are manufactured under the highest standards of quality control in the industry.

2 HIGHER PERFORMANCE AT LOWER COST

High efficiency throughout life adds to your savings by reducing power consumption—thus lowering your plating costs. And most important

of all—International Rectifiers *last longer*—a factor made possible by the development of new and better methods of manufacture.

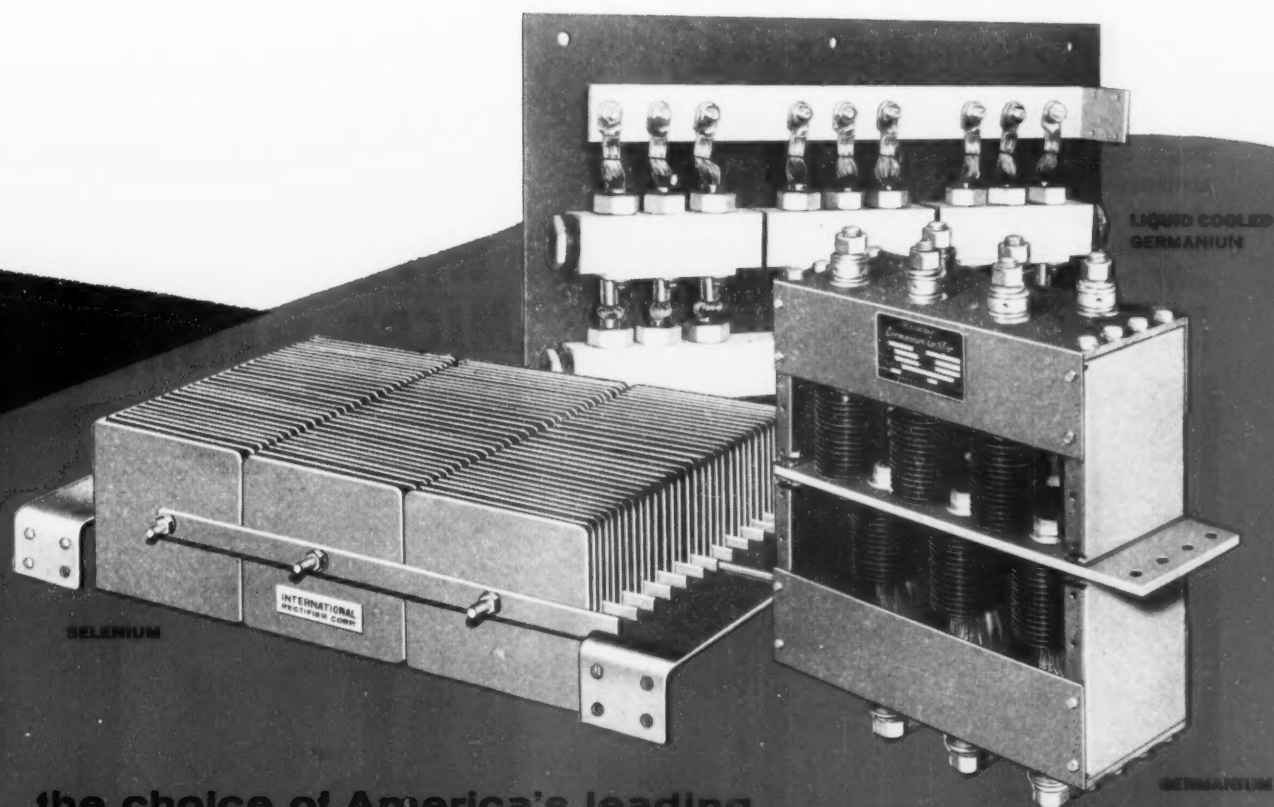
3 WIDEST RANGE OF SIZES AND TYPES AVAILABLE

Long the leader in the development of more efficient Selenium rectifiers, International recently introduced a complete line of Germanium power units, offering superior advantages to the plating industry. This progressive move highlights the diligent research and development program at International.

4 EVERY UNIT GUARANTEED

Installed in original equipment, or as a replacement, every unit is guaranteed by International to perform to the specifications set forth. This guarantee is backed by their reputation as an acknowledged leader in the field.

e for EXPERIENCE!



...the choice of America's leading
plating equipment manufacturers



LOOK FOR THESE NAME-PLATES

ON YOUR RECTIFIER STACKS

*Your assurance of higher efficiency,
longer life—unsurpassed quality,
backed by experience!*



A WORLD OF DIFFERENCE
THROUGH RESEARCH

International Rectifier

C O R P O R A T I O N

EXECUTIVE OFFICES: EL SEGUNDO, CALIFORNIA • PHONE OREGON 8-6281

NEW YORK: 132 E. 70TH ST., TRAFALGAR 9-3330 • CHICAGO: 205 W. WACKER DR., FRANKLIN 2-3889

IN CANADA: ATLAS RADIO CORP., LTD., 50 WINGOLD AVE. W., TORONTO, ONTARIO, RU 1-6174

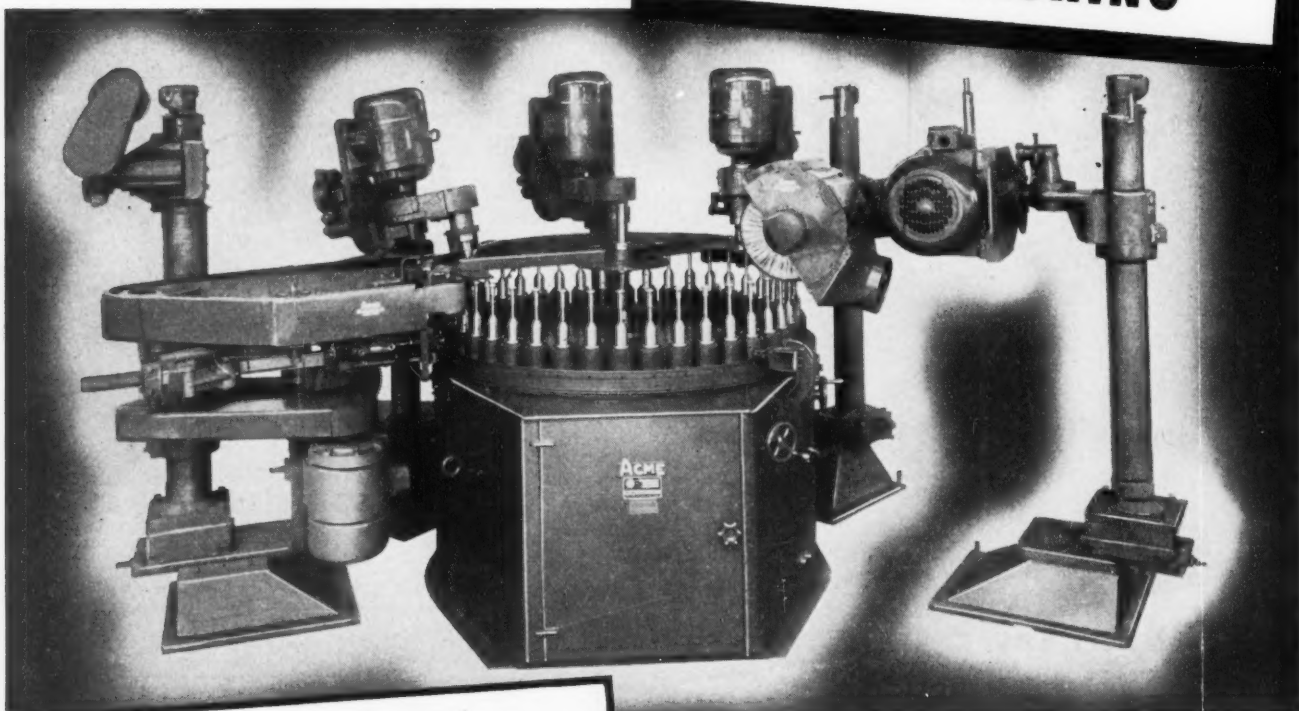
THE WORLD'S LARGEST SUPPLIER OF INDUSTRIAL METALLIC RECTIFIERS

ACME *Automatics*

**OFFER THE SOLUTION to MANY PROBLEMS of
PRODUCTION FINISHING**

Production finishing demands not only high output at low unit cost, but also a uniform finish meeting required standards. Acme Automatics can be depended upon to deliver high production at minimum cost and maintain your finish requirements. Acme performance has been proved in production for nearly half a century.

**POLISHING and BUFFING
DE-BURRING
WIRE BRUSHING
MICRO-FINISHING**



**ROTARY *Automatics*
STRAIGHT LINE *Automatics*
SEMI-*Automatics*
Catalogs on Request**

Recommendations & Quotations

For recommendations, send blue prints of part or samples before and after finishing operations, together with detailed information on finishing operations and production requirements. If production methods will cut your costs, we can set your job up in our experimental processing department and you can inspect the machines in operation.



ACME *Manufacturing Co.*

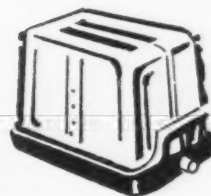
1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

Builders

OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 35 YEARS

HARSHAW Nubrite

bright nickel plating process



long operation without treatment

Other outstanding advantages are:

BRIGHT OVER WIDE RANGE

from a few amperes/ft.²
to well over 100 amperes/ft.²

HIGH TOLERANCE to common impurities

HIGHLY RECEPTIVE to chrome

EXCELLENT LEVELING

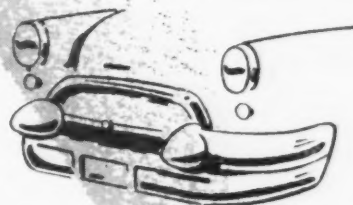
BETTER BRIGHTNESS with thinner deposits.

SIMPLE OPERATION and CONTROL

Plates brightly from 120°F to 155°F.
pH can vary over a wide range.
Liquid addition agents.

REMAINS DUCTILE AFTER LONG OPERATION

*For additional information contact
the Harshaw office nearest you.*

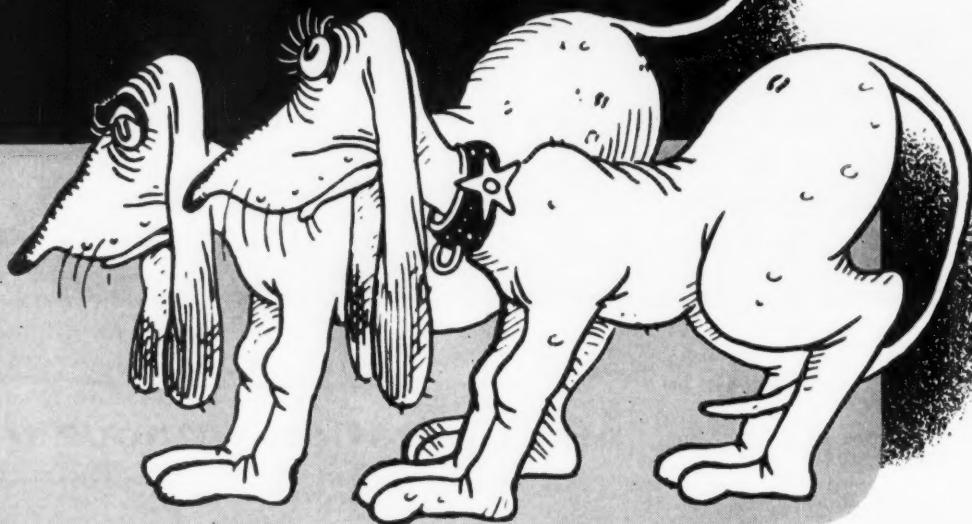


THE HARSHAW CHEMICAL CO.

1945 East 97th Street • Cleveland 6, Ohio

Chicago 32, Ill. • Cincinnati 13, Ohio • Cleveland 6, Ohio • Houston 11, Texas • Los Angeles 22, Calif.
Detroit 28, Michigan • Philadelphia 48, Penna. • Pittsburgh 22, Penna. • Hastings-On-Hudson 6, N. Y.

Not a Trace



... of RESIDUE, that is with **NEW** AHCO Burnishing Compounds

Residue vanishes in a water rinse... burnished surfaces are left clean, bright, and film-free, but it's no mystery because this new series of AHCO Burnishing Compounds is formulated only from non-saponaceous materials that contain the last word in surface-active agents. These compounds are free-flowing, dry, non-toxic, and non-corrosive powders which are, of course, freely soluble in water. They're prepared especially for applications where the sticky residues from soap-like mixtures are objection-

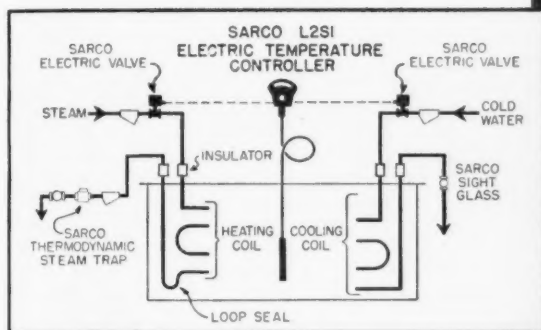
able. For rolling and burnishing before plating, AHCO burnishing Compounds assure excellent adhesion and maximum lustre. For preparing surfaces before lacquering, painting or other processing... for burnishing plated parts to remove plating compound residues, that would cause staining or spotting, there are AHCO Burnishing Compounds made to order. Find out *now* how one or more of the many new AHCO Burnishing Compounds can do that better job in your plating or finishing room.



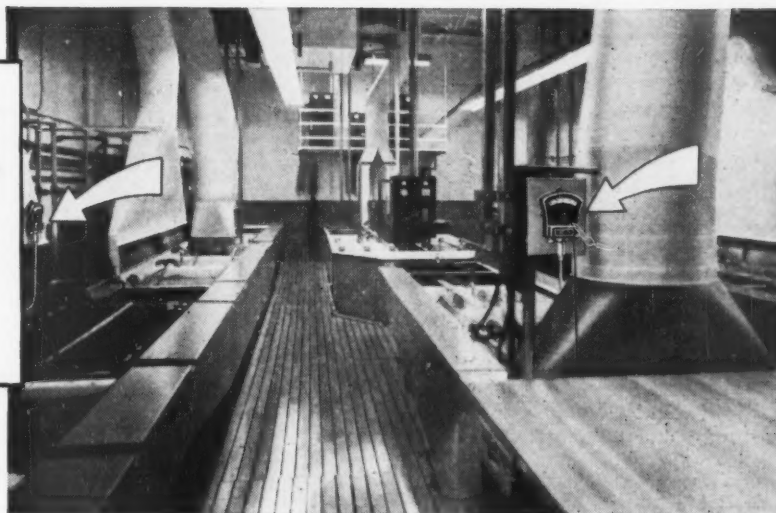
For full details about AHCO Burnishing Compounds write today for Bulletin B-10 to Apothecaries Hall Co., 22 Benedict Street, Waterbury, Connecticut.

Apothecaries Hall Co.

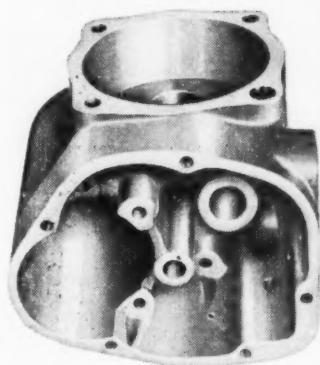




Scientific plating department of Woodward Governor Co., Rockford, Ill., meets exacting government specifications. All plating and cleaning process tanks are equipped with Sarcos Electric Indicating Temperature Controllers.



Tough precision plating problem solved by low-cost Temperature Control



0.0002" tolerance held by Woodward Governor
in plating irregular and deeply recessed surfaces

PROBLEM—Look at the above case for an aircraft propeller governor. Its irregular shape and deep recesses present a tough plating problem.

Furthermore, Uncle Sam specified a top quality plate with a thickness tolerance of 0.0003 to 0.0005 inch... to assure mating of parts.

SOLUTION—Key to the solution of this precision plating problem is control of all the variables...and by far the most important is *bath temperature*. When it fluctuates, so does the plate quality... current density is affected...and, therefore, throwing power varies, causing uneven plate thickness.

That is why *all* Woodward Governor plating tanks are equipped with Sarcos

Electric Indicating Temperature Controllers, which automatically hold the plating solutions to $\pm \frac{1}{2}^{\circ}\text{F}$.

RESULTS—A top-quality deposit. Throwing power that assures uniform plating thickness on all surfaces... plane, irregular and recessed. Tolerance of 0.0002 inch... actually closer than government specifications. Minimum rejects.

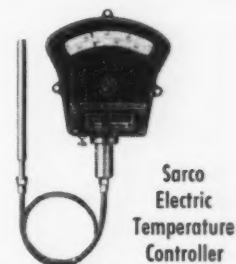
Mr. Delbert L. Zeigler, plant manager of Woodward Governor, writes: "Sarcos Electric Temperature Controls are doing an excellent job in every way."

Write for Handbook No. 6 or consult your plating supplies jobber. Sarcos Company, Inc., Empire State Bldg., New York 1, N. Y.

2130-B

SARCO

improves product quality and output



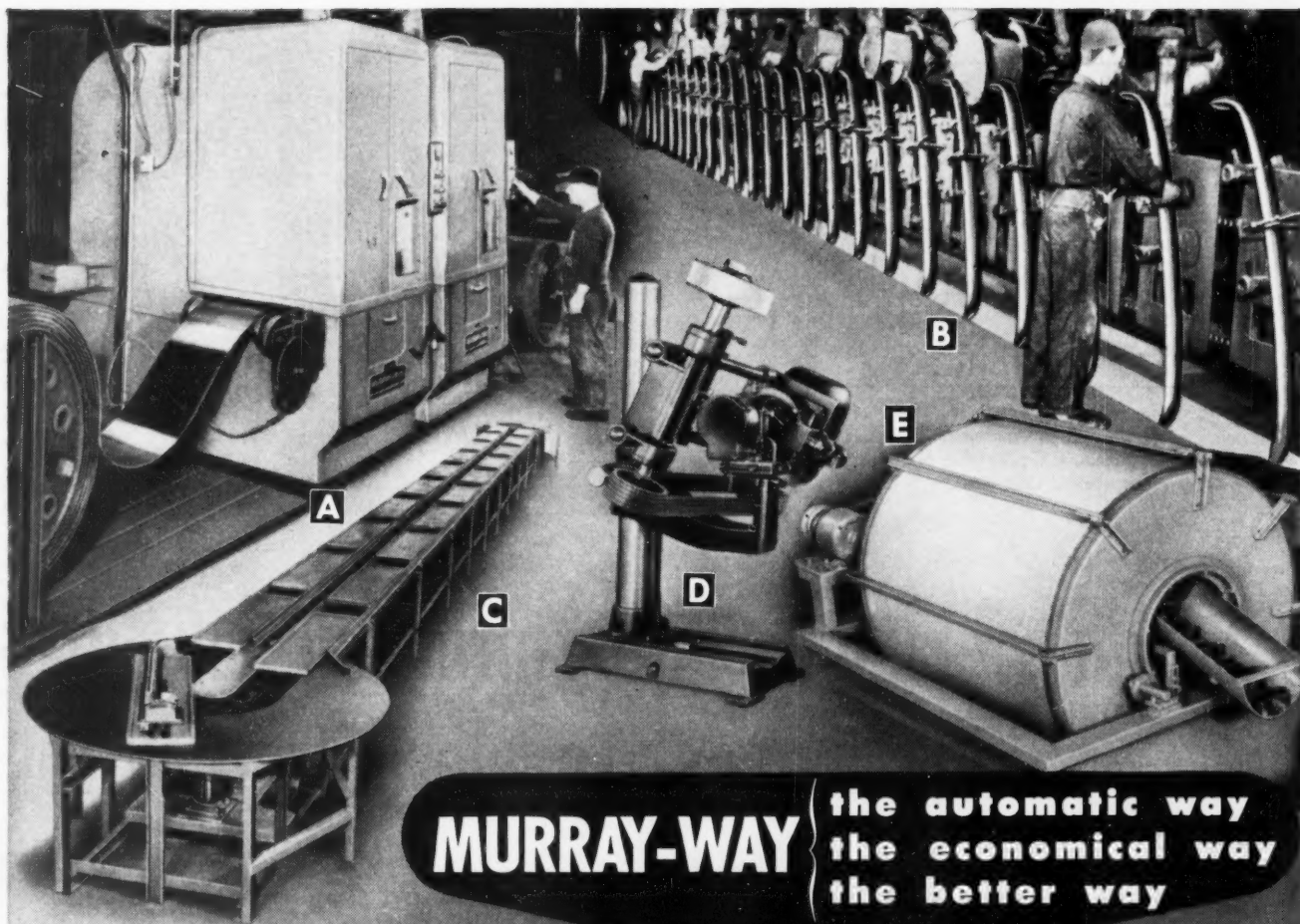
ADVANTAGES FOR ALL TYPES OF PLATING

LOW COST—about \$100

EASY ADJUSTMENT—turn one knob to change temperature setting

ELIMINATES DIFFICULTIES often caused by unreliable manual temperature control:

- Changes in current density
- Variations in plate thickness
- Variations in quality
- Dull finishes
- Breakdown of plating solutions
- Crystallization of salts
- Rejects



MURRAY-WAY { the automatic way
the economical way
the better way

to POLISH... BUFF... GRIND... FILTER

Whatever your job . . . whatever your problem . . . Murray-Way automatic equipment will do that job better and more economically.

These are just a few illustrations of Murray-Way's success in beating production cost with the finest automatic equipment available.

You can depend on Murray-Way engineering, Murray-Way experience, Murray-Way equipment to solve your production problems.

A. Micro-Polish—Continuous Strip Polishing Installation

B. Vertical-Platen Conveyor

C. Horizontal-Platen Conveyor

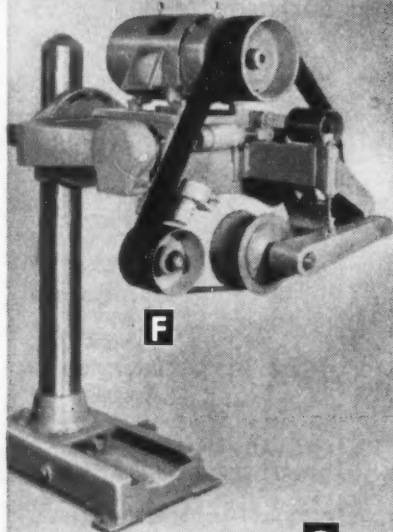
D. #51 Universal Polishing Head—One of Several Standard Polishing Heads

E. The Automatic, Self-Cleaning, Compact Filter

F. #72 Series Belt Polishing Head

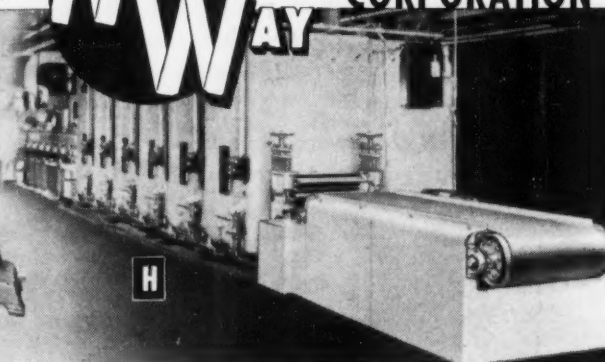
G. Indexing Dial Table

H. Six Micro-Polish Units in Series



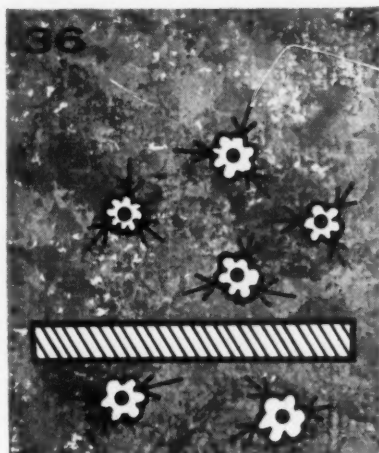
P. O. Box 180, Maple Road, E.
Birmingham, Michigan

MURRAY-WAY CORPORATION

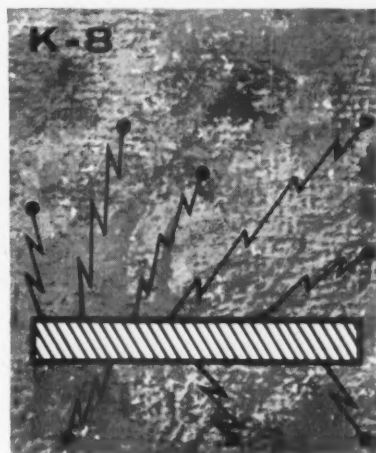


CONSISTENT, STREAK-FREE PLATING OF STEEL AND COPPER STARTS WITH PENNSALT'S Super-Cycle

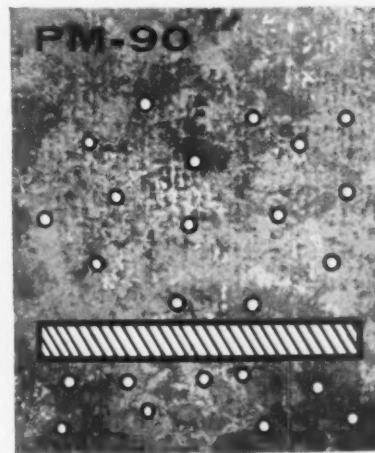
It's the whole cycle, used as Pennsalt recommends, that gives you maximum control over your cleaning line, minimum plating rejects. Here it is:



PENNSALT CLEANER 36. Soak cleaner extraordinary, 36 (as illustrated above) removes more soil, more kinds of soil, than other leading cleaners tested. And soils removed in 36 won't re-deposit on work—sequestering agents keep them suspended.



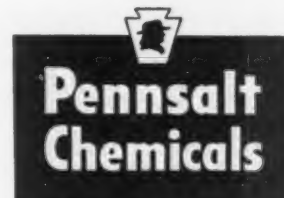
PENNSALT ELECTROCLEANER K-8*. As shown above, this highly conductive cleaner "blasts" off stubborn pickling smuts with minimum voltages, gets under impacted machining lubricants, prepares base metal for a bright, adherent plate.



PENNSALT PM-90 INHIBITED-ACID PICKLE. After 36 and K-8, the controlled action of PM-90® pickling removes all traces of rust and scale. Balanced composition of PM-90 rids bath of fuming and uncertainty once associated with this operation.

The **whole Super-Cycle** really gives you more than your money's worth in pre-plating preparation. Ask your Pennsalt man or write Metal Processing Dept. 295, Pennsylvania Salt Manufacturing Company. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: Woolsey Bldg., 2168 Shattuck Ave., Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

*K-8 IS A TRADEMARK OF PENNSYLVANIA SALT MFG. CO.



Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

A B E T T E R S T A R T F O R Y O U R F I N I S H
METAL FINISHING, May, 1956

ALUMINUM FINISHES



by **A. B. HOEFER**
vice president
FREDERIC B. STEVENS, INC.

THE FINISHING TOUCH

Will Anodized Aluminum Replace Nickel-Chrome Finishes?

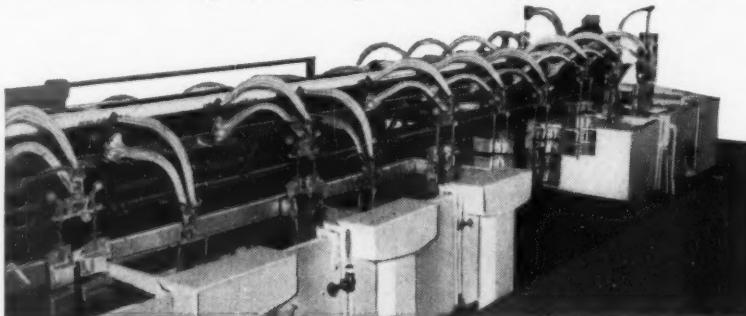
Affirmative answers to this question are revealed in several current business publications and our own sales figures.

Speeding the change is the continued tight supply of nickel. Manufacturers have been forced to look for substitutes for nickel and like the results anodized aluminum have given them.

A trend is developing. Volume of Stevens Automatic anodizing equipment sold in 1955 was nearly double the volume for the two preceding years. At the same time, sales of Stevens compositions used in buffing and polishing aluminum were showing a 50% increase.

Frederic B. Stevens, Inc., manufacture equipment for both nickel-chrome and aluminum finishes. We believe both types of finishes will increase in demand but at the moment the interest in aluminum is high.

If you are considering aluminum for your product, you can be assured that aluminum parts can be bright anodized and finished to compare favorably with the fine finish of chrome plate. In addition, aluminum can be dyed, resulting in non-fading colored finishes.



Typical Stevens Automatic Processing Machine Used for Bright Anodizing

Stevens aluminum anodizing equipment is presently being used and recommended in the finishing of colored anodized tumblers, utensils, refrigerator components, rivets, automotive trim, lighting reflectors, etc.

Stevens' experience in furnishing complete anodizing equipment installations assures you of the latest techniques—the finest finishes—at the lowest costs.

For long range planning consider the versatility of Stevens Automatic equipment. Changes of cycles or processes can be accomplished quickly and inexpensively. Your Stevens Automatic Processing Machine for anodizing can be changed to a nickel-chrome cycle at a later date.

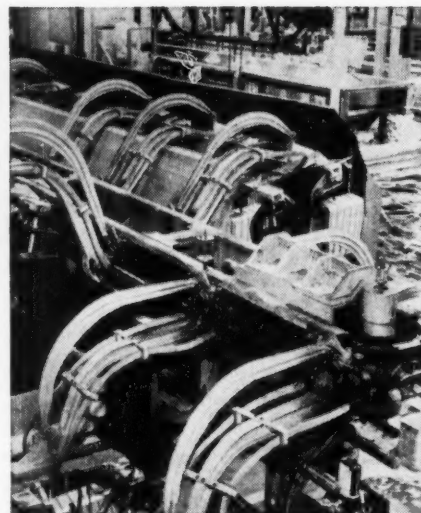
If your design engineers are talking of aluminum to add sales appeal excitement, cost reducing features to your new product lines, let us discuss your requirements with you.

For further information write to Frederic B. Stevens, Inc., Detroit 16, Michigan.

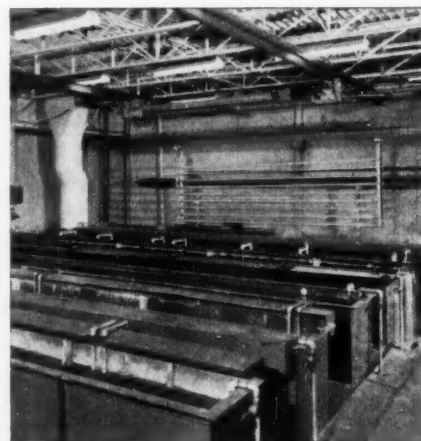


**METAL FINISHING EQUIPMENT AND SUPPLIES
FROM CASTINGS OR STAMPINGS TO
FINISHED PRODUCT**

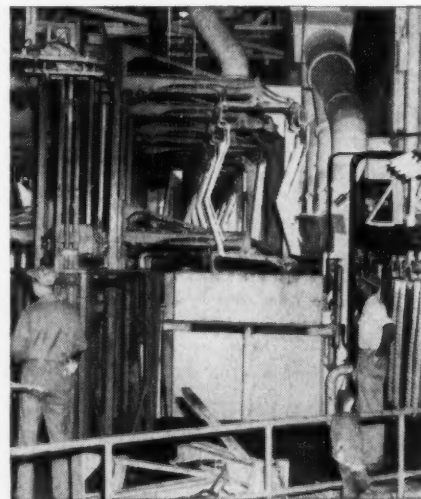
BRANCHES:
Buffalo • Cleveland • Indianapolis • New Haven



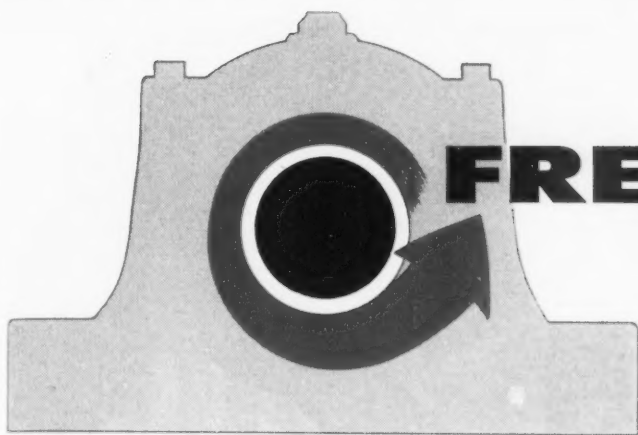
Stevens Model "B" Automatic Processing Equipment used in anodizing refrigerator evaporators.



Stevens Still Tank installation for anodizing extruded architectural and aircraft parts.



Automatic "Stevadoer" used in anodizing grille sections for leading automotive manufacturer.



FREE RIDE...

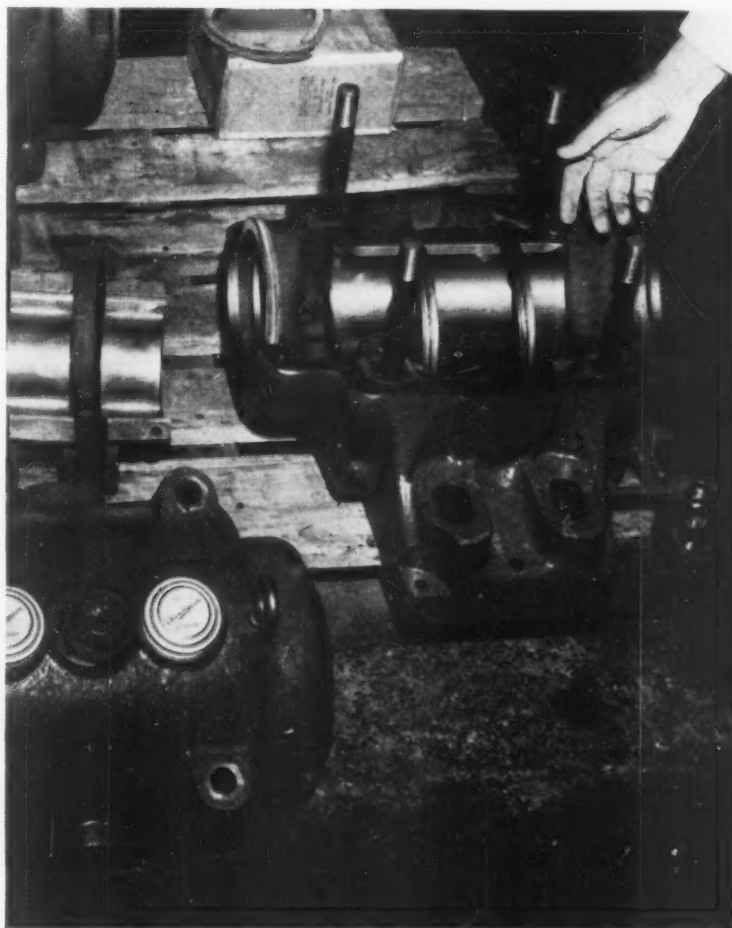
to give you the most
low-voltage power
for your money

Chandeysson

SELF-ALIGNING BEARINGS ELIMINATE A MAJOR CAUSE OF FRICTION

You always know that the big, rugged shaft of a Chandeysson Motor Generator is exactly in line with its bearings. Special "self-aligning" bearings automatically compensate for normal deficiencies in foundation level or foundation settling. Inside the pillow block, the bearing liner "rides" in a machined pocket. For added freedom from friction, patented oil rings provide plenty of lubrication along the entire journal.

Advanced ideas such as this are always incorporated in Chandeysson Motor Generators. Unified responsibility for the manufacture of every component... from selected raw materials to the finished product... is in the hands of skilled men with decades of experience in building low-voltage generators. Our aim in engineering is to *prevent* design defects... rather than to correct for them. This is why more and more "Industry Leaders Choose Chandeysson!"



MAKE US PROVE to you that a Chandeysson Motor Generator set is your most economical and dependable source of low-voltage dc current. Mail this coupon today...



CHANDEYSSON ELECTRIC COMPANY
4074 Bingham Avenue, St. Louis 16, Mo.

Please send bulletin D-102

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

CHANDEYSSON ELECTRIC COMPANY

- 4074 Bingham Avenue, St. Louis 16, Mo.

CHA-85

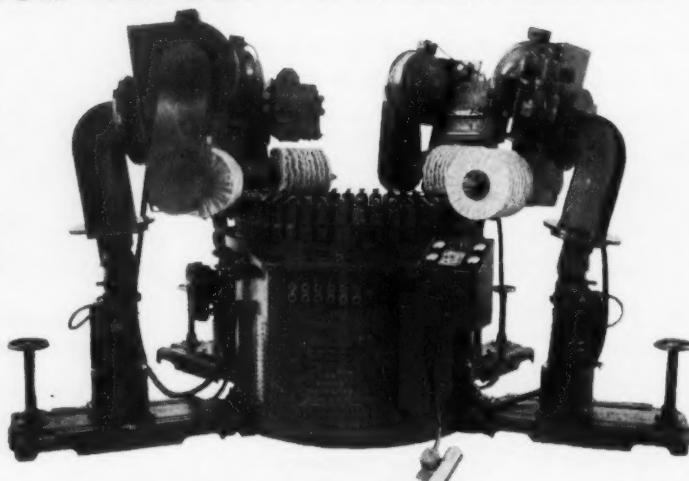


"I STILL PREFER MY FOUR-HEADED PACKER-MATIC"

Four or more heads on Packer automatics are the answer when polishing, buffing, or deburring production lags in your finishing room.

For handling long production runs, small odd-lot jobs or a mixture of both—Packer-Matics are easily adapted to many change-over setups, produce consistently better finishes in a fraction of hand operation time.

Packer-Matics are designed specifically to perform a multiplicity of jobs with an efficiency that will increase customer satisfaction and profit.



No. 14-45 CONTINUOUS ROTARY

OUR ENGINEERING STAFF INVITES YOUR INQUIRY.

P A C K E R - M A T I C

AUTOMATIC MACHINES FOR BUFFING • POLISHING • DEBURRING

THE PACKER MACHINE COMPANY • MERIDEN, CONNECTICUT

For Positive-BUT SAFE Cold Degreasing

Use  **METHYLENE CHLORIDE**
The Non-flammable, Low-toxicity Solvent

Solvay Methylene Chloride has an outstanding ability to dissolve greases, oils, tars, waxes and many other organic substances. This property, combined with non-flammability and low toxicity, makes it an ideal cold degreasing solvent for industrial use.

In many operations, satisfactory cleaning can be accomplished with Solvay Methylene Chloride alone. For more difficult operations, methylene chloride has found successful use as a rough cleaning stage before vapor degreasing. In this application it affords higher efficiency and reduces the production delays required for cleaning vapor degreasers.

In addition, methylene chloride may be used in combination with other solvents such as ortho-dichlorobenzene, perchloroethylene and naphtha. In fact, it is often used in such mixtures to reduce the flammability of the other components.

SOLVAY PROCESS DIVISION



ALLIED CHEMICAL & DYE CORPORATION
61 Broadway, New York 6, N. Y.

BRANCH SALES OFFICES:

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
Houston • New Orleans • New York • Philadelphia • Pittsburgh
St. Louis • Syracuse

Soda Ash • Snowflake® Crystals • Potassium Carbonate • Chloroform
Calcium Chloride • Sodium Bicarbonate • Ammonium Bicarbonate
Cleaning Compounds • Caustic Potash • Sodium Nitrite • Chlorine
Ammonium Chloride • Monochlorobenzene • Para-dichlorobenzene
Ortho-dichlorobenzene • Carbon Tetrachloride • Methylene Chloride
Methyl Chloride • Caustic Soda • Hydrogen Peroxide

USE SOLVAY METHYLENE CHLORIDE FOR VAPOR DEGREASING

Methylene chloride is an excellent—and safe—vapor degreasing solvent when used in equipment especially designed for the purpose. If you are interested in this type of degreasing operation, we will be glad to supply specific information.

For additional information on the use of Solvay Methylene Chloride as a degreasing solvent, fill out and mail the coupon today. There is no cost or obligation.*

*In Western Hemisphere countries.



SOLVAY PROCESS DIVISION

ALLIED CHEMICAL & DYE CORPORATION
61 Broadway, New York 6, N. Y.

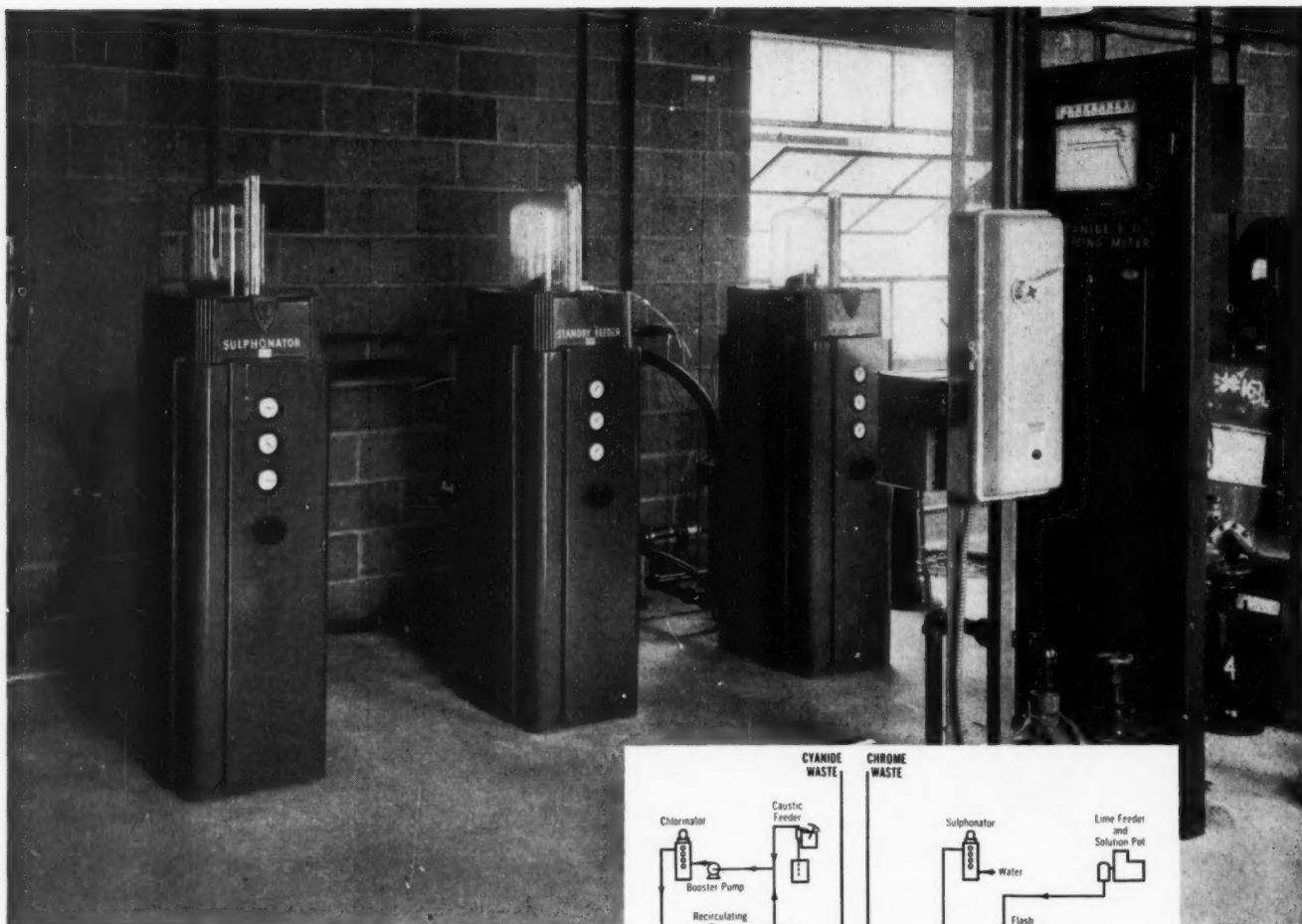
- ☐ Please send me further information on methylene chloride as a cold degreasing solvent.
- ☐ Please send me specific information on the use of methylene chloride in vapor degreasing.
- ☐ Reprint—"Methylene Chloride for Raising Solvent Flash Points."

NAME _____

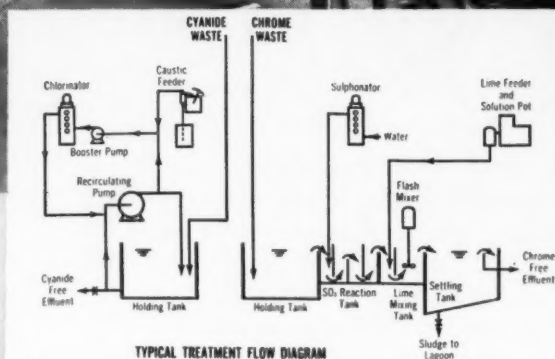
ORGANIZATION _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____ EG-5



**DAYSTROM
INSTRUMENT
DIVISION
USES**



W&T *Cyanide & Chrome Waste Treatment*

The Daystrom Instrument Division of Daystrom, Incorporated, located at Archbald, Pennsylvania, has provided a compact and efficient treating plant to destroy the toxic components of their plating waste. The treatment plant has been in continuous operation since 1953.

The cyanide bearing waste is treated with chlorine and caustic, using a W&T Water Diaphragm Chlorinator and a W&T Chemical Solution Feeder. The treatment breaks down the cyanide

to harmless carbon dioxide and nitrogen gas components.

The chromium bearing waste is treated with sulphur dioxide and lime, using a W&T Sulphonator and a W&T Dry Chemical Feeder. The treatment removes the toxic chromium and other heavy metals from solution, to be disposed of as sludge.

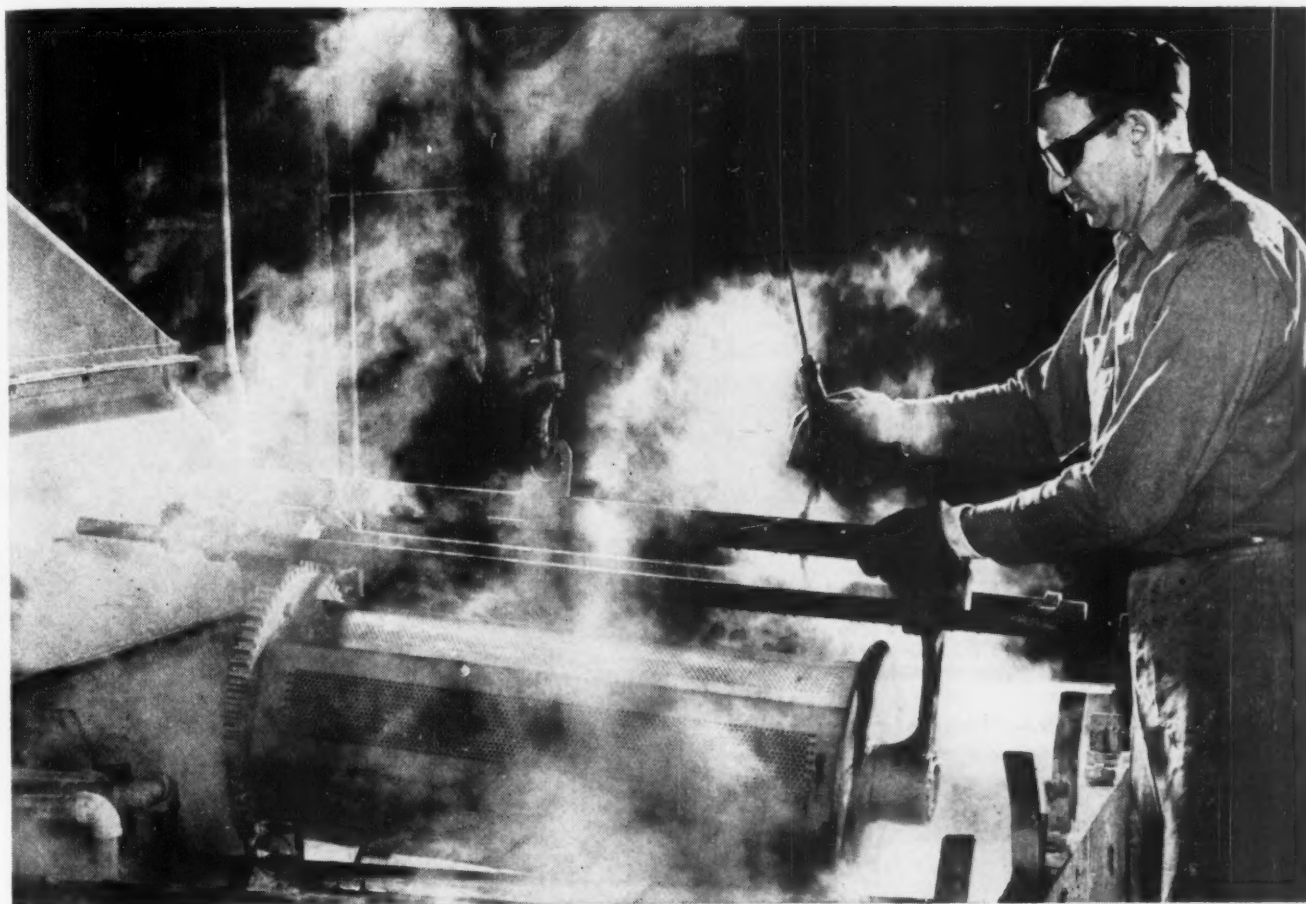
If you would like more information on Wallace & Tiernan cyanide or chromium waste treatment, write for bulletin RA-2120-CM.



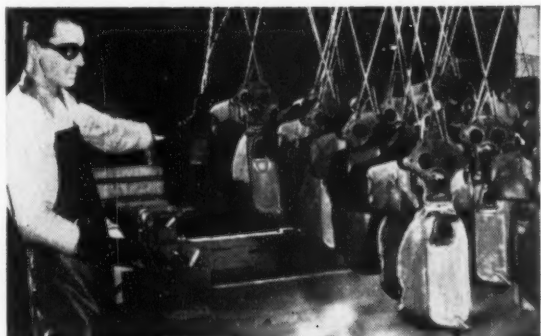
WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

I-52



DOW SODIUM ORTHOSILICATE



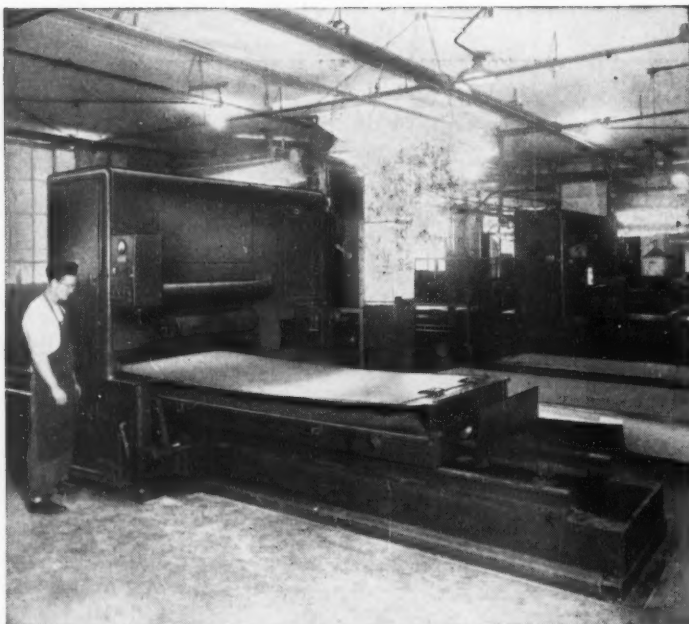
Heaviest-duty cleaning at once-over-lightly speed and cost

Name your roughest job . . . its size, shape, the finish you're applying. How to clean it? Without argument, Dow Sodium Orthosilicate cleaning compound.

Oils, fats, waxes . . . Dow Sodium Orthosilicate's high acid capacity and high pH give uniform, reject-free cleaning run after run. You can use it economically with dip, soak or electrolytic operations. There's a particularly good saving on electrolytic: solutions of Dow Sodium Orthosilicate have very high electrical conductivity, permitting any current density *without* excessive voltage.

Ready emulsification, no redeposition, fewer rejects and lowered cost per run. No wonder it's Dow Sodium Orthosilicate, without argument. Get your order in *today*. THE DOW CHEMICAL COMPANY, Dept. AL 760J-1, Midland, Michigan.

you can depend on DOW CHEMICALS



HILL Sheet Grinder and Polisher with reciprocating hydraulic table processing individual sheets.

HILL Pinch Roll Grinder and Polisher for "Wet" or "Dry" operations. (Shown in series for straight line production)



HILL

GRINDING and POLISHING MACHINES

*How much is it costing
you to produce **ACCEPTABLE**
finishes on **FLAT** surfaces*

HILL 2-Roll Vertical Abrasive Belt Grinding and Polishing machines are the logical result of 25 years of research and experience in producing self contained units for successfully processing ferrous and non-ferrous sheets. We have consistently proven that wide abrasive belt grinding and polishing equipment must incorporate these fundamental features — rugged construction, simplicity of design, accessibility, versatility and centralized controls.

HILL abrasive belt polishing machines are recommended for continuous operation and insure lower production costs with superior finishes as required today by the manufacturers of decorative plastics, food processing equipment, automobile bumpers, lithographers and photo engravers plates, home appliances, etc., etc.

Both types of machines are normally built up to 60" wide, and larger capacity equipment can also be furnished.

Your inquiries are solicited for detailed information and recommendations.



THE HILL ACME COMPANY

1209 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES



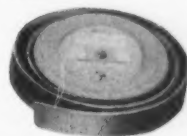
BELTS



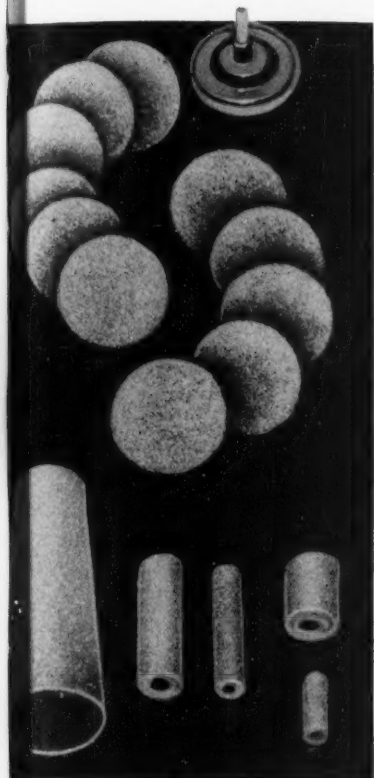
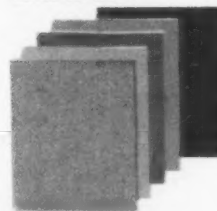
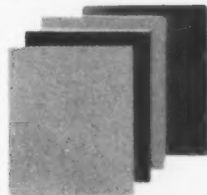
BELTS



ROLLS



SHEETS



SPECIALTIES

for **sharper** cutting...
 for **cleaner** cutting...
 for **smoother** finishing...

try the line where you can—

see the difference...

feel the difference...

and **actually prove**
 the difference—

Michigan

ABRASIVES

For proof... Turn page



RED COAT
BRAND

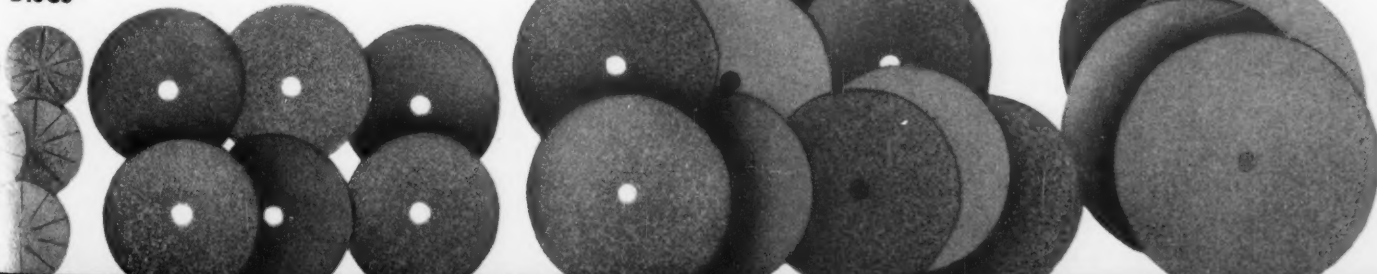
MICHIGAN ABRASIVE COMPANY

Manufacturers of

'The Humidity-Controlled Abrasive'

DETROIT 5, MICHIGAN

DISCS

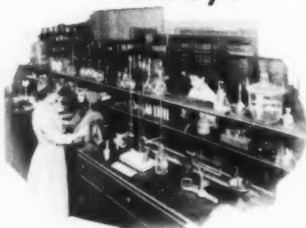


Other reasons why

Michigan

ABRASIVES

are better for you
to buy!—



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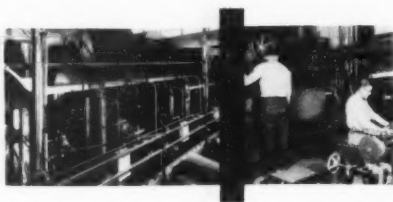
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due to highest grade of raw material and most modern quality control



PROMPT SERVICE...

both from our company and from our stocking distributors located in every U. S. industrial area!



PLENTIFUL SUPPLY...

due to unmatched precision-coating equipment and enormous specially-designed blowers and heaters... and one of the most modern, single-purpose coated abrasive manufacturing plants in the world...



**THE COMPLETE
QUALITY LINE...**
from wide belts
like this to small
specialties!



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You SEE the difference because most all Michigan Abrasive products are red in color—*different on sight* from other abrasives!

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AND WE CAN ACTUALLY PROVE THE DIFFERENCE in your plant or shop... to your conditions and specifications!

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FOR TRIAL DEMONSTRATION!

One of our abrasive engineering specialists will bring proper abrasive products, show you how much more quickly and cleanly stock is removed...and finished to your specifications!

Michigan

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**Sharper cutting... Cleaner cutting
Smoother finishing**

MICHIGAN ABRASIVE COMPANY

Manufacturers of

'The Humidity-Controlled Abrasive'

11900 E. 8-MILE ROAD • DETROIT 5, MICHIGAN

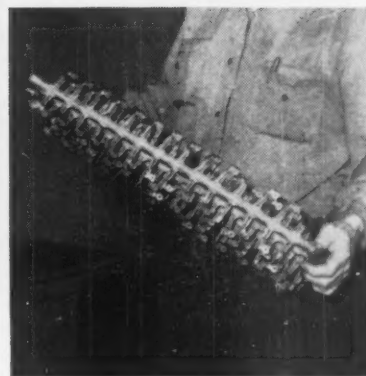
Telephone LAkeview 7-2050



All yours for **Sharper** cutting... **Cleaner** cutting



Here, workman prepares MERSOCLEAN 540 pre-soak for zinc die castings and other metals. After soaking in MERSOCLEAN 540, parts are spray-washed with a Wyandotte alkaline cleaner.



Academy Plating removes stubborn buffing compounds with new Mersoclean 540 process


The Academy Plating Co. of Newark, New Jersey, was looking for an economical, yet more effective way to remove impacted buffing compounds from brass and steel—and from zinc die castings, which they manufacture and finish. Although trying to cut costs, they also wanted to lower the number of rejects caused by inadequate cleaning prior to plating.

That's where Wyandotte's brand-new MERSOCLEAN 540 and

companion products entered the picture and solved Academy's problems. The safe, nontoxic, highly effective MERSOCLEAN 540 process eliminated expensive degreasing solvents; buffing compounds were completely removed, even in deep crevices. The result: fewer rejects, less labor, and increased production.

For complete facts on MERSOCLEAN 540—and other Wyandotte metal-cleaning products—contact our nearest representative.

Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.

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CHEMICALS

J. B. FORD DIVISION

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METAL-CLEANING PRODUCTS**

DAVIS-K GOLD PLATING SOLUTIONS

ALL DAVIS-K Gold Plating Solutions Are:

- Made in all colors
- Color-constant
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NOW AVAILABLE — Variable-type Tank Rheostats . . . specifically designed for precious metal plating.

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America's foremost electronic manufacturers give their unqualified approval to this New Hard Gold Solution, which Davis-K developed specifically for printed circuits and electronic parts.

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We are fully equipped to reclaim old gold and rhodium solutions.

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Antique Gold Solution

A QUALITY SOLUTION, with excellent color consistency and remarkable ease of operation. No production problems — truly economical, too!

"Where Glittering Elegance Reflects Lasting Quality."



DAVIS-K PRODUCTS, CO.

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Longacre 4-1978-9

avoid costly rejects due to unacceptable coating thickness...

For quality control and acceptance tests, measure thickness of coatings on metals the easy, accurate, non-destructive way, with the . . .

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Widely used by industry and government for accurately measuring the thickness of:

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2. Nickel coatings on magnetic or non-magnetic base metals.

Measures coatings on plane, convex or concave surfaces. Gives speedy and accurate results. Easy to use by non-technical personnel.

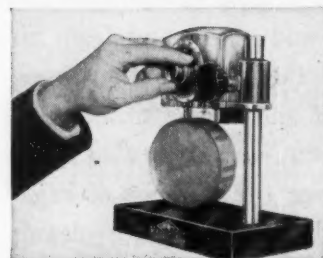
Avoids expensive rejections due to coatings that may be too thin, or non-uniform. Eliminates the expense involved in re-plating or discarding specimens spoiled by destructive tests . . . every piece tested is unharmed and ready for use or shipment. Saves materials wasted by coatings thicker than necessary. Its use leads to the discovery of faults that may exist in plating methods or equipment.

Write for Bulletin 2253-G

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Silver Spring, Maryland • In Metropolitan Washington, D. C.



Coating on cylindrical object being measured with Magne-Gage

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6 volts, 1500 amps . **\$1565.00 ***

12 volts, 1000 amps . **\$1616.00 ***

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*Manufacturer's suggested user price.



Prices refer to integral tap switch unit shown here.

NOW EVERY PLATING SHOP can take advantage of the long life and operating savings of germanium with:

1 THE UNIQUE G-E TRUE HERMETICALLY SEALED GERMANIUM CELL—that safeguards the germanium from corrosive atmosphere.

2 THE UNIQUE G-E GERMANIUM PROTECTIVE SYSTEM—the first protective device designed specially to help safeguard the germanium cell against all types of overloads. Provides an original advance-warning feature to help prevent costly, sudden shutdowns.

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GENERAL  ELECTRIC

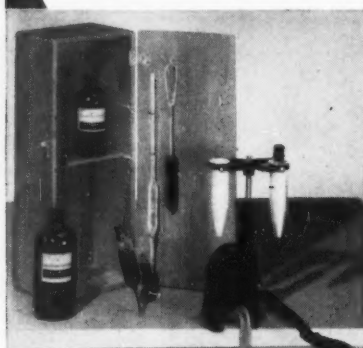
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CLEVELAND ELECTRIC CO., Atlanta, Ga.
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LEA MANUFACTURING CO., Waterbury, Conn.
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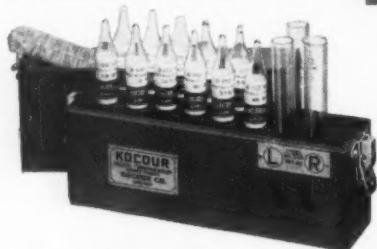
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INCREASE YOUR PRODUCTION WITH KOCOUR PLATING TEST EQUIPMENT



● The KOCOUR Chromic Acid Test Set was designed to accurately and simply determine the chromic acid content of chromium solutions. While a hydrometer is sometimes used for this determination, if close control is desired, the solution should be analyzed.

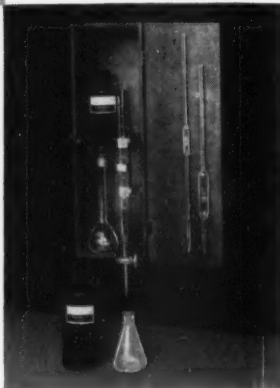
The set is self-contained . . . reads directly . . . is accurate to the one-half ounce per gallon of chromic acid . . . one simple subtraction is the only necessary calculation.



set is simple to operate . . . cost of upkeep small . . . no calculations are necessary.

All successful platers know that using KOCOUR plating test equipment means better plating, more production, lower costs, increased profits.

● The KOCOUR Sulfate Test Set enables anyone to accurately and quickly determine the sulfate content of a chromium plating bath in order to maintain a constant check on the ratio of sulfates to chromic acid. . . . This is important to insure consistently good plating results. . . . The entire test takes about 7 minutes . . . no calculations are necessary.



● Many platers use the KOCOUR Set "CR" for determining trivalent chromium in chromium solutions. The importance of this set is that a chromium solution high or low in trivalent chromium is not only expensive to operate but also is the cause of much spoiled work. The

● KOCOUR are specialists and pioneers in testing equipment for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements. Write today for further information—no cost or obligation.

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Specify KOCOUR test sets from your supplier.

another product improved . . .

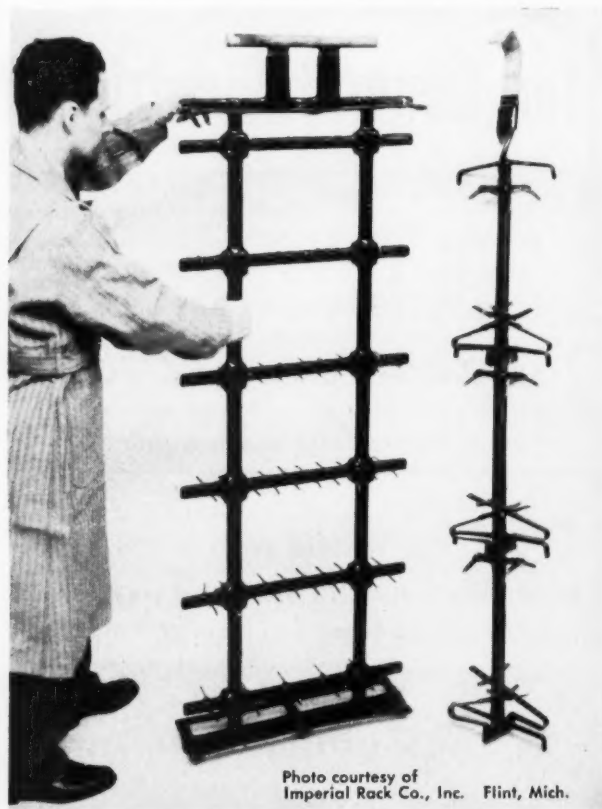


Photo courtesy of Imperial Rack Co., Inc. Flint, Mich.

chem-o-sol® coating adds life to these PLATING RACKS

Chem-o-sol's excellent chemical and heat resistance means longer life for plating racks and other plating equipment.

A smooth, rapidly draining coating of **chem-o-sol** on plating racks will reduce carry-over of solutions, protect them from contamination.

This special **chem-o-sol** can be applied to equipment in just one dipping operation. Also available in spraying form for in-shop application to bulky equipment such as tanks, fans and other items subject to corrosive deterioration.

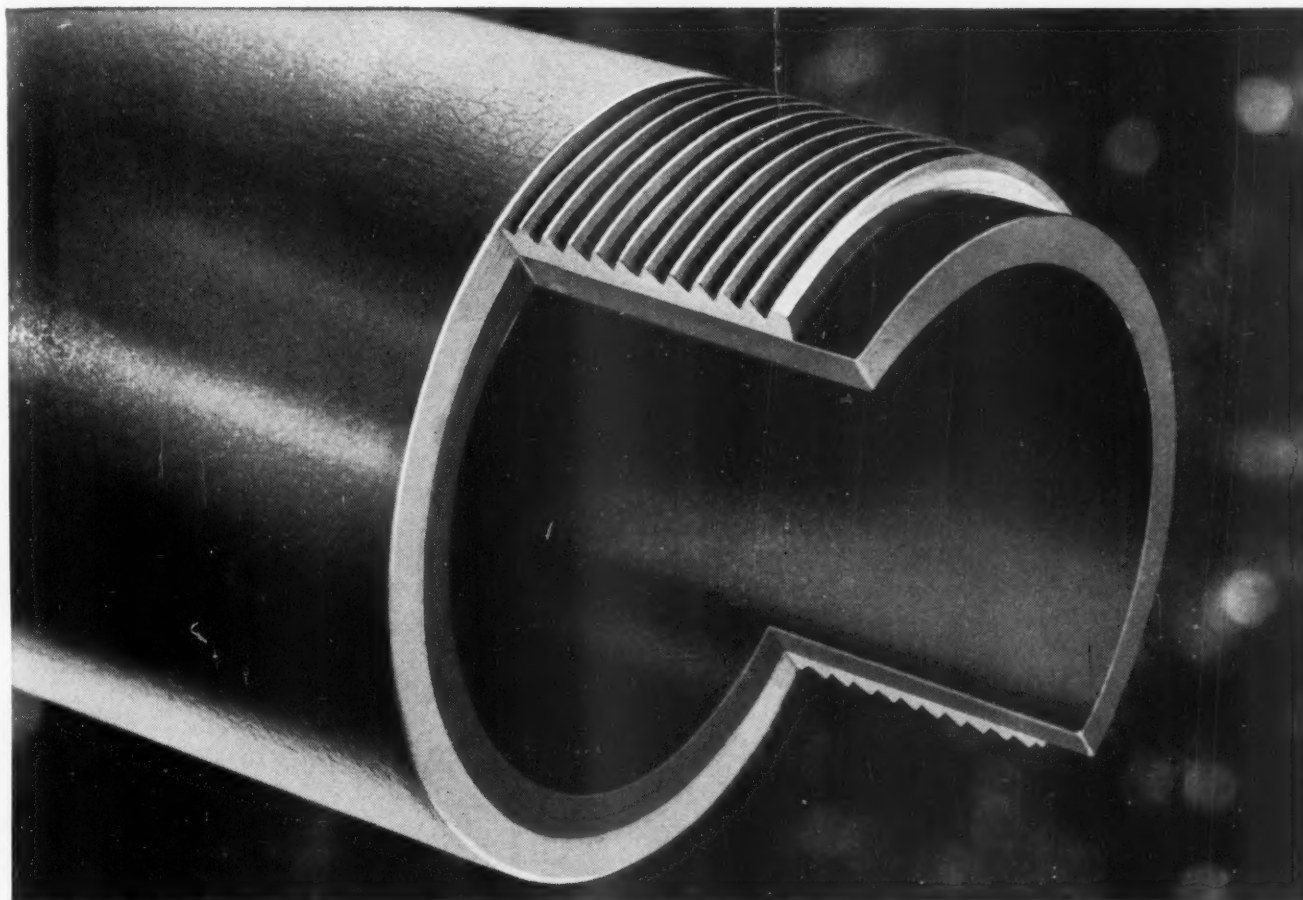
Our custom formulated plastisol (**chem-o-sol**) has been tailored to the plating industry by a company whose experience has covered many years as well as many industries. We have developed **chem-o-sols** for application by dipping, molding, spraying, die-wiping, spreader coating, printing, and many other methods.

Our laboratory and research facilities are at your service. We welcome your inquiries and your problems.

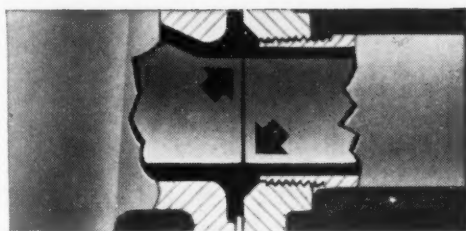
Chemical Products CORPORATION



KING PHILIP ROAD • EAST PROVIDENCE, R. I.



You can see why Saran Lined Pipe cuts corrosion costs



Liquid never touches metal in saran lined pipe even at a flanged connection like this.

Saran Lined Pipe Company
2415 Burdette Avenue
Ferndale 20, Michigan
Dept. SP626C

Please send me information on saran lined pipe, fittings and valves.

Name _____ Title _____

Company _____

Address _____

City _____ State _____

Saran Lined Pipe is Manufactured by
The Dow Chemical Company, Midland, Michigan.

It's made of corrosion-resistant saran swaged into rigid non-bursting steel . . . liquid never touches metal in these installations

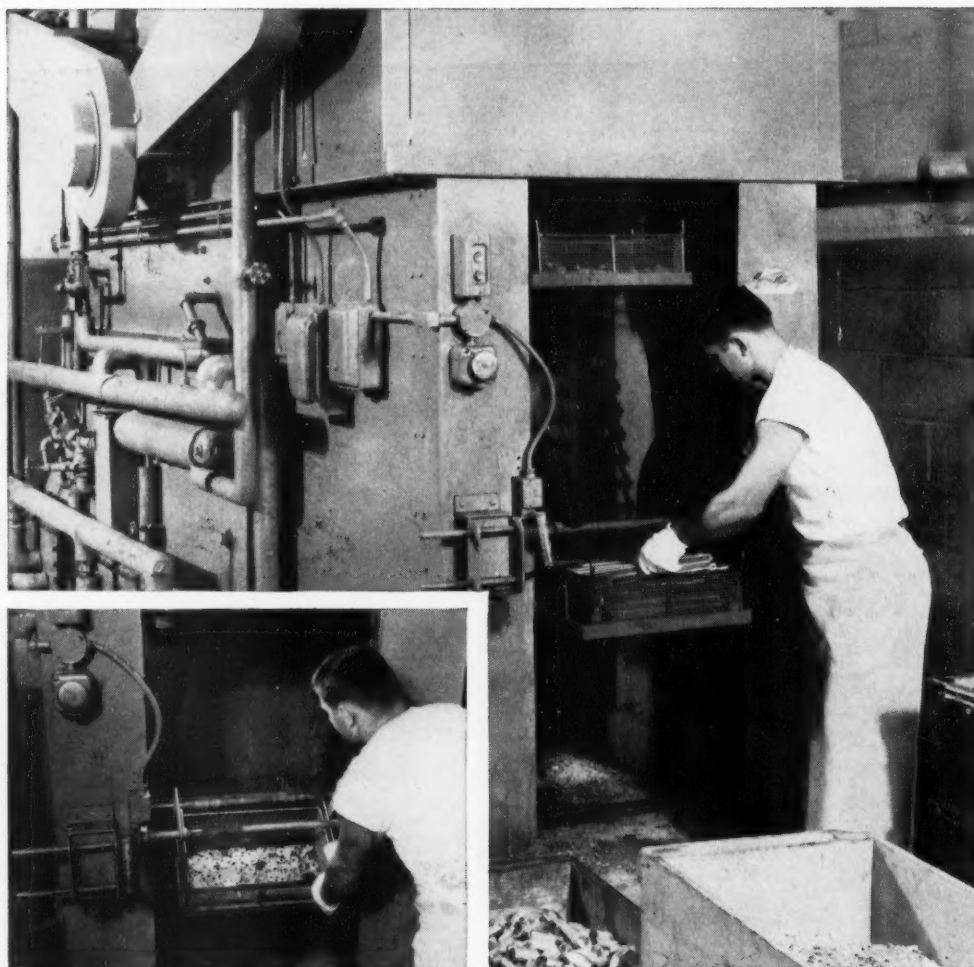
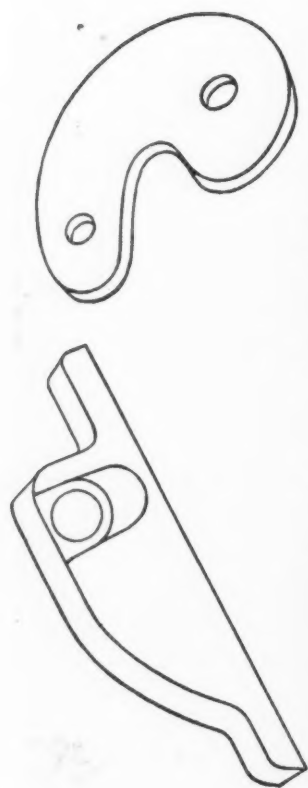
Here's your best way to convey acids, alkalis and other corrosive liquids—saran lined pipe, fittings, and valves. This modern piping is corrosion resistant . . . forms snug, leakproof joints . . . is available for working pressures up to 150 psi. Fittings and valves are also available in steel for working pressures to 300 psi.

Installation costs are low because saran lined pipe can be cut and threaded in the field with available pipe fitter's tools. Its rigidity means few supporting structures are needed.

Saran lined pipe has an outstanding record of trouble-free performance in many industries. THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on **DOW PLASTICS**

DOW



CONVEYORIZED DEGREASER at Standard-Thomson Corp. is loaded by operator.

THOROUGHLY CLEANED with "TRICLENE" D in a single operation, parts are taken from the degreaser.

Standard-Thomson Corp. reports: "TRICLENE® D eliminates solvent-control worries...cuts degreasing costs"

Says George Mitchell, Chief Chemist

"We started using 'TRICLENE' D trichlorethylene over a year ago, and since then we haven't had a single concern about solvent condition. Our only control procedure is a pH check once a month, and we've noticed a reduction in rejects due to etching and staining."

Standard-Thomson, Dayton, Ohio, manufactures a variety of building hardware, automobile and aircraft accessories. They operate four vapor degreasers—three manual and one conveyorized. Since changing to "TRICLENE" D they've been able to eliminate bright dipping of brass parts, and have increased the time between degreaser cleanouts from two weeks to six weeks.

An exclusive combination of locked-in stabilizers gives "TRICLENE" D unequaled resistance to all major causes of solvent deterioration—heat, light, air, acids and aluminum chlorides. Yet Du Pont's rugged solvent contains no salt-form-

ing inhibitors to stain or etch precision-machined parts. Even after repeated use and distillation, "TRICLENE" D retains its original high purity . . . continues giving efficient, trouble-free cleaning of any metal, job after job. And remember, it costs no more than ordinary solvents!

FOR MORE INFORMATION on "TRICLENE" D trichlorethylene, write to the nearest district office of E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Dept., Wilmington 98, Delaware.



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TRICLENE® D

TRICHLORETHYLENE



Announcing

ROHCO®

SUPER XL

CADMIUM BRIGHTENER

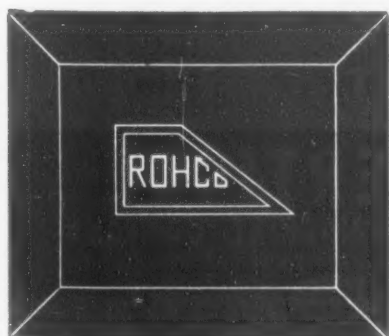
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2. Has amazingly wide latitude of concentration range—for even more simple control.
3. Is supplied as either liquid or powder, as preferred, in highly concentrated form. You save on freight and container costs.
4. Changeover from ROHCO 20XL does not require company or government specification changes—no conversion problem.

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"THE HULL CELL TEST MAKES PLATING BEST"

***Iolyte* LAMINATED FIBERGLASS FOR CORROSION RESISTANCE**



***Iolyte* TANKS**

Fabricated
to your
Specifications

NO MOLDS NEEDED—Made any size, any shape, at no extra cost and no loss of delivery time.

UNIFORM DIMENSIONS — NO TAPERING—Dimensions are same at bottom and top . . . means larger capacities than tapered molded tanks.

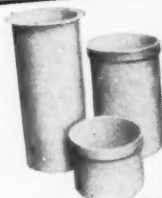
FLANGES, DAMS, Etc.—Can be inexpensively equipped with flanged connection, holes, overflow dams, baffles, separations, etc.

CHEMICALLY RESISTANT THROUGHOUT—Fabricated from *Iolyte* sheet properly reinforced. This is a structural material . . . not a lining.

Write for literature, prices, and table of chemical resistance for *Iolyte* tanks, crocks, ducts.

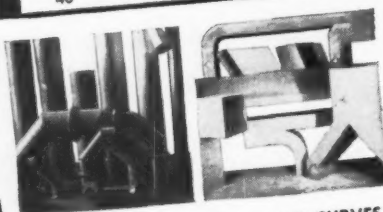
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from Stock



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8	10"	15"	18.00	20	18"	18"	40.00
10	12"	16"	22.00	26	18"	24"	45.00
12	12"	20"	24.00	30	18"	28"	49.00
12	12"	24"	26.00	40	18"	36"	59.00
9	10"	24"	23.00	50	18"	48"	69.00
7	9"	24"	21.00	27	22"	18"	49.00
10	16"	12"	26.00	30	22"	20"	53.00
12	16"	14"	28.00	35	22"	36"	70.00
15	16"	18"	33.00	73	22"	48"	83.00
20	16"	24"	40.00	55	28"	22"	76.00
30	16"	36"	49.00	95	28"	36"	98.00
40	16"	48"	59.00	125	28"	48"	125.00



***Iolyte* DUCTS**

ANY DIMENSIONS ANY CURVES ANY LENGTHS

Iolyte has greater resistance to chemical attack than stainless, Monel, or aluminum. 1/5 the weight of steel, it is superior in tension, flexural, and compression strength. Unlike thermoplastics *Iolyte* will not heat-distort below 350 deg.

Send drawings or prints for quotes and ask for literature giving chemical resistances.

Order from us or your distributor. Unless rated firm, payment with order. No COD's.

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Nickel anodes up to 93 inches in length—cast in new shell mold process. This unique method of casting produces anodes of the highest purity—with optimum metallurgical properties. Density of anodes is at a maximum and excellent surface is obtained. These factors account for longer life in plating bath.

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ANY QUANTITY only 99+ purity accepted

15^c PER POUND

FOB UNIVERTICAL

Laboratory Controlled

Write or wire for best price and delivery on the following Anodes:

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Copper-Cast Round 3" Dia.
Copper-Cast Round 2½" Dia.
Copper-Cast Beehives
Copper-Cast Balls
Copper-Forged Balls
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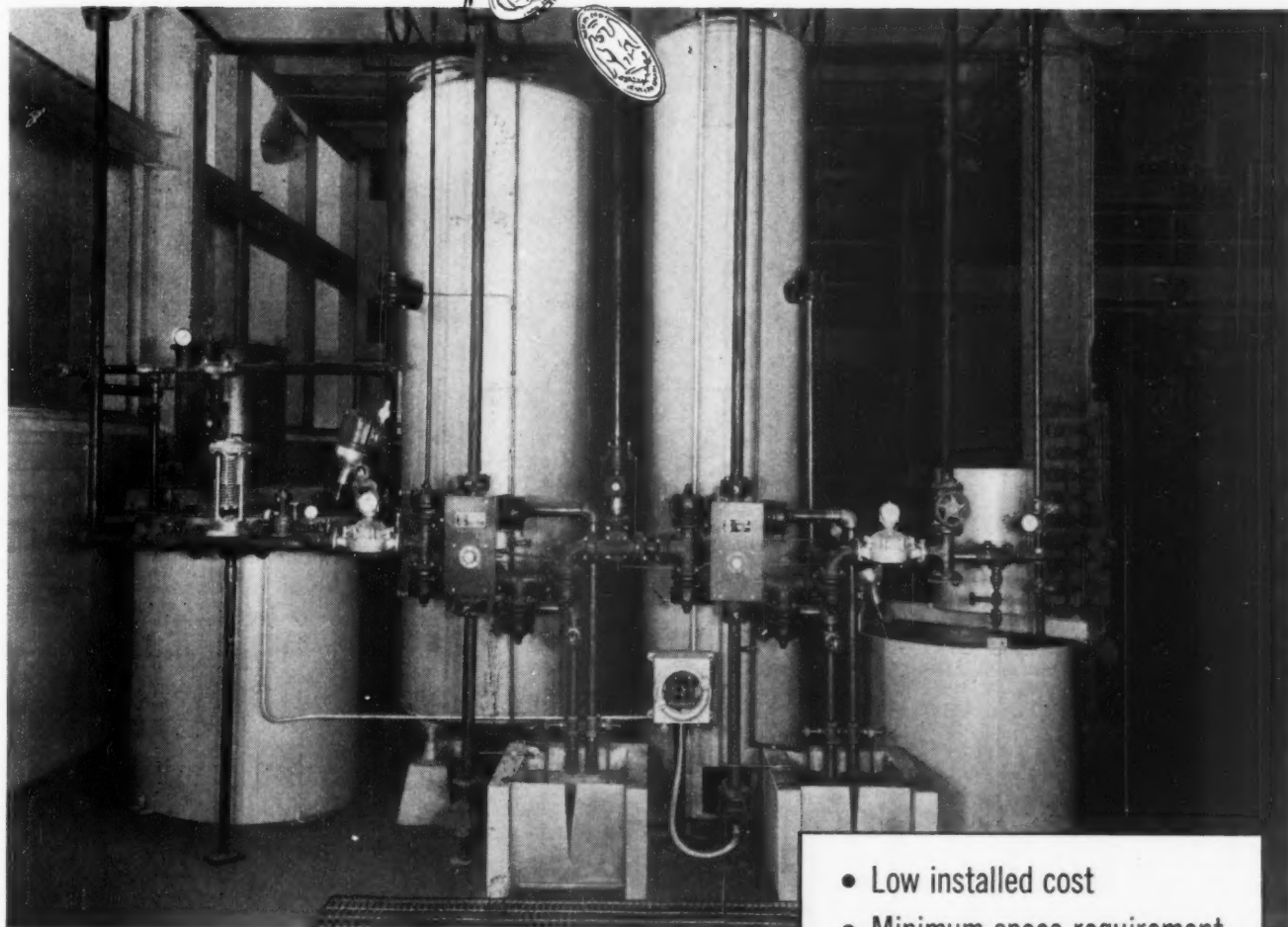
Phos. Copper
White Brass
Zinc
Tin
Lead
Carbon

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The ONE company offering equipment for ALL types of water and waste treatment—coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

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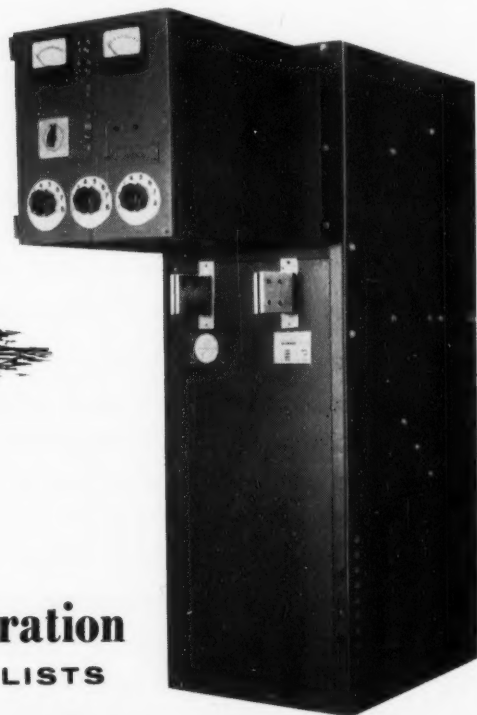
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The **NEW**
MITCHELL-BRADFORD

Emulsion Cleaner

#26

A NEW organic emulsion cleaner designed for easy removal of heavy oils, greases and soils.

EMULSION CLEANER #26 is a general utility cleaner which cuts cleaning time when used prior to an alkali cleaner. Emulsion Cleaner #26 will even increase the life of the alkali cleaner.

EMULSION CLEANER #26 softens grease and grime for easy removal with a cold water rinse.

EMULSION CLEANER #26 will easily remove buffing compounds and is ideal for cleaning heavy machinery, airplane bodies, truck bodies, floors, etc.

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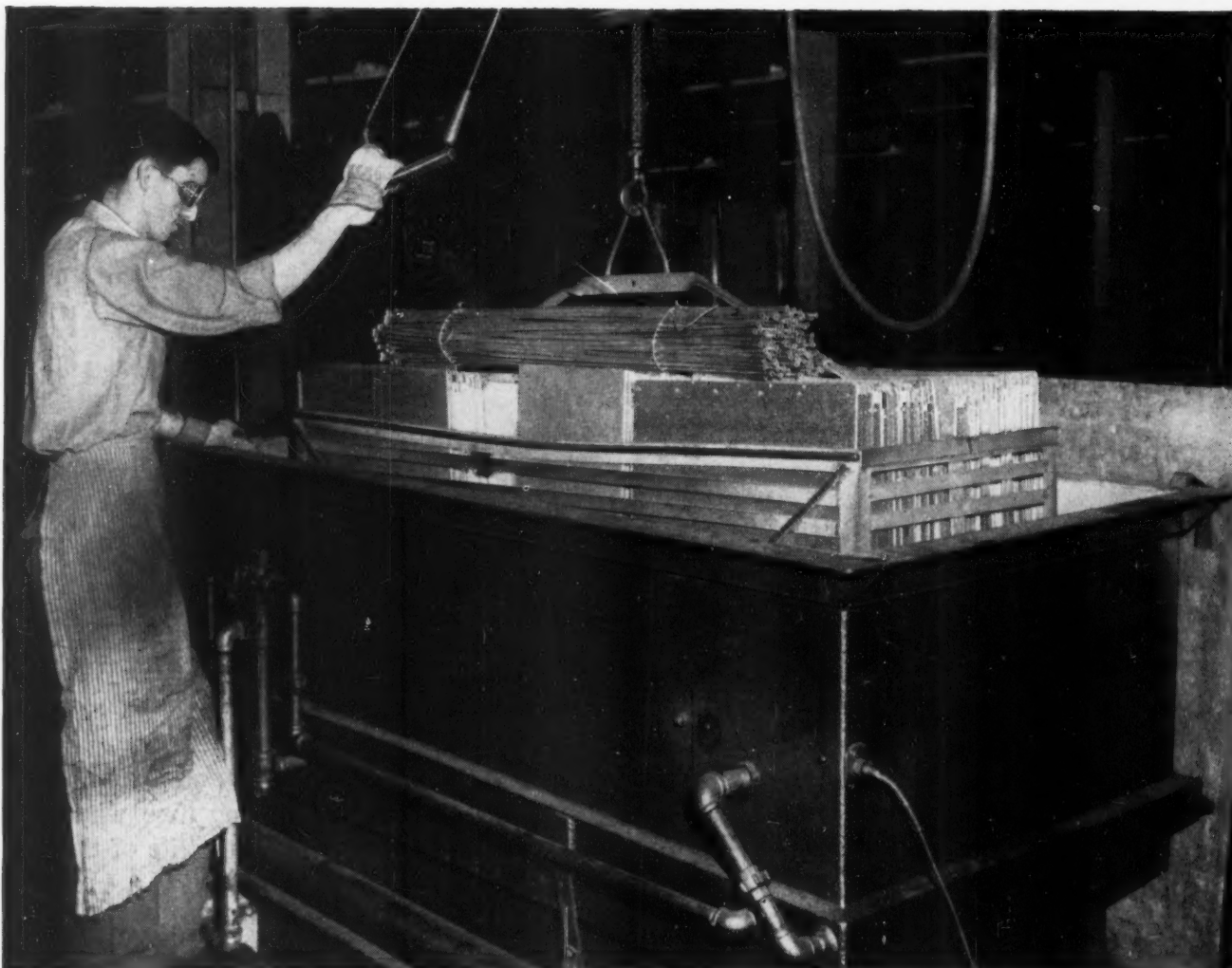
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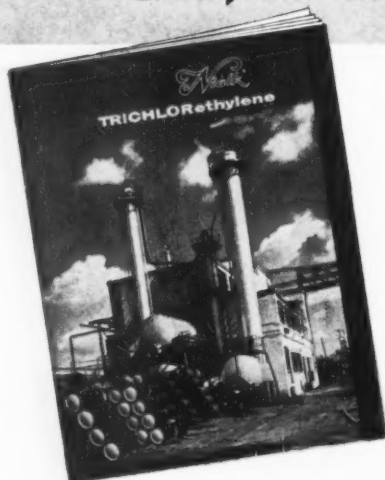
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MAY, 1956

Volume 54 Number 5

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Published Monthly By

Finishing Publications, Inc.

Established in 1903 as Metal Industry by Palmer H. Langdon 1868-1935.

Also publishers of ORGANIC FINISHING and
annual GUIDEBOOKS and DIRECTORIES.

381 Broadway, Westwood, N. J.
WEStwood 5-1530

L. H. Langdon, President-Treasurer; Palmer H. Langdon, Publisher; Thomas A. Trumbour, General Manager; Joan T. Wiarda, Sales Manager; Nathaniel Hall, Technical Editor; Fred A. Herr, Pacific Coast Editor; John E. Trumbour, Equipment & News Editor; Inez Oquendo, Assistant Editor; Elizabeth Meyers, Circulation Manager.

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219 West 7th St.
MAdison 6-5421

Chicago 1
35 East Wacker Drive
FIAnancial 6-1865

SUBSCRIPTION INFORMATION

United States and Canada \$4.00 per year, other countries \$8.00. Single copies 45c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 24th edition 1956 current, 606 pages 5 1/4 x 7 7/8 \$3.50. Please remit by check or money order; cash should be registered. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Copyright 1956 by Finishing Publications, Inc. All rights reserved. Contributed articles, letters on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

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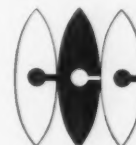
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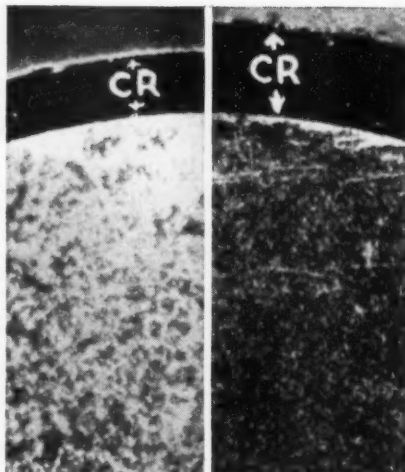
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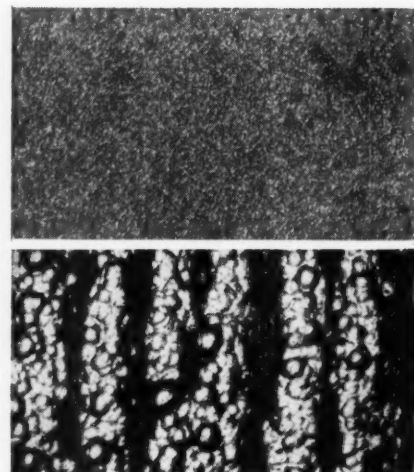


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Macrograph of steel rod cross section at left with 0.016" chromium deposited in 16 hours by ordinary solution. Identical rod section at right in SRHS under identical conditions got 40% thicker deposit.



Surface photomicrographs: SRHS Chromium (top) levels over surface irregularities. Ordinary chromium at bottom shows no such action. Both baths operated 7 hours under identical conditions.

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Disappearing Craftsmen

Once upon a time, every practitioner of a trade was an artisan, every worker was a craftsman. Then came the Industrial Revolution and, in many fields of mass production, workers became machine tenders, able to perform only one or, at most, but a few operations on a part. Industry no longer needed men who could take the raw materials and turn out a finished product all by themselves, and craftsmen began to disappear from the scene.

Our own industry has been late in experiencing the impact of this transformation but it has not been passed over by any means. Stamped designs have reduced the demand for hand chasers to the point where the trade has become practically a lost art. How many of today's finishers have ever seen a set of hand-burnishing tools, much less a burnisher at work? Or, a real old-fashioned sand bobber? It was not too long ago when the average silverware refinisher could not only repolish and replating but would undertake to hammer out dents, resolder broken attachments and fill in engraved initials so the ware looked *exactly* like new, not *almost* like it. Today, a survey of the nation's large cities will turn up only a handful of these craftsmen and, when they are gone, there will be no others to take their place.

This, of course, is one of the prices of progress. However, our industry has not yet reached that stage of mechanization where we can eliminate the practical polisher and plater, despite our advances in automatic equipment. Walk through any large plant and, alongside the straight line and rotary automatic polishers, a few hand polishing lathes will also be spinning away because there are still a multitude of articles which can only be polished and buffed by hand. What superintendent would consider operating a full-automatic plating machine without a good plater on hand who can recognize a water-break or the appearance of any of the other numerous indications of incipient trouble? Would anyone in such circumstances attempt to depend on the laboratory to run its tests while, in the meantime, the machine continues to turn out defective work?

It would appear that, as the field expands, we must, more and more, rely on the practical men. Yet the outlook is not encouraging. We are training a generation of foremen and supervisors but are not offering sufficient inducement, it seems, for young workers to learn the trade. As a result, it is becoming more difficult each year to obtain polishers and platers. Plating schools, which are in session in a number of cities, are doing much to familiarize the practical man with the technical aspects, but they are not a substitute for practical experience. We must get the men into the plants first.

Nathaniel Hall

Surface Treatment and Finishing of Light Metals

Part VIII. — Hard Anodizing

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M., and R. Pinner, B.Sc.

THE first work carried out in the production of thick and hard anodic coatings for engineering applications with oxalic acid¹⁰ has been described on the Continent, and with sulphuric acid in Russia¹¹ and in England.¹² Tomashov showed that, by cooling the sulphuric acid electrolyte and thus slowing down the rate of dissolution of the oxide, coatings of up to 10 mil could be obtained with a loss of metal of only about 0.3 g./sq. dm., and that these coatings could give excellent wear resistance and heat insulation and would absorb and retain oil when used on cylinders and pistons, etc.

As has been described, the limiting film thickness is reached when the rate of chemical dissolution of the film in the electrolyte, which increases with the greater exposed area at the surface layer pores, is equal to the rate of film growth, which decreases as the ohmic resistance of the film increases and by the effect of side reactions. Increase of the limiting thickness, therefore, might be obtained by lowering the temperature, acid

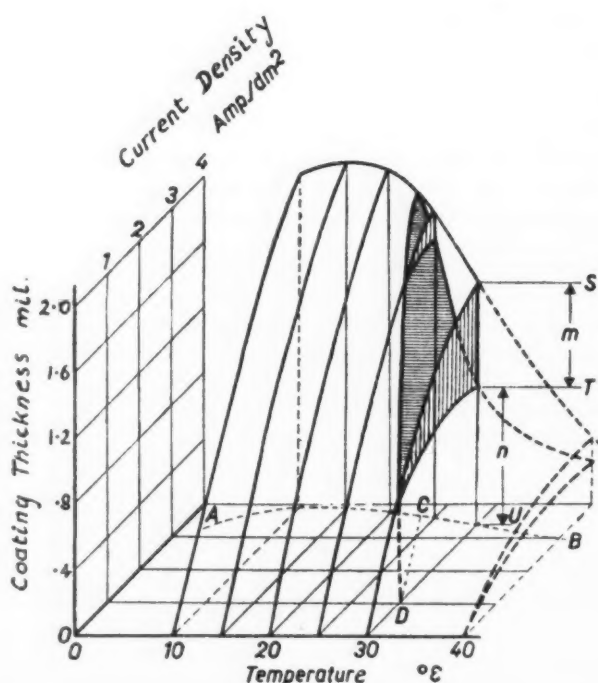


Fig. 1. Anodic-coating thickness produced on aluminum (99.5%) in 10% sulphuric acid after 45 min. Vertical hatching shows soft outer layer.¹

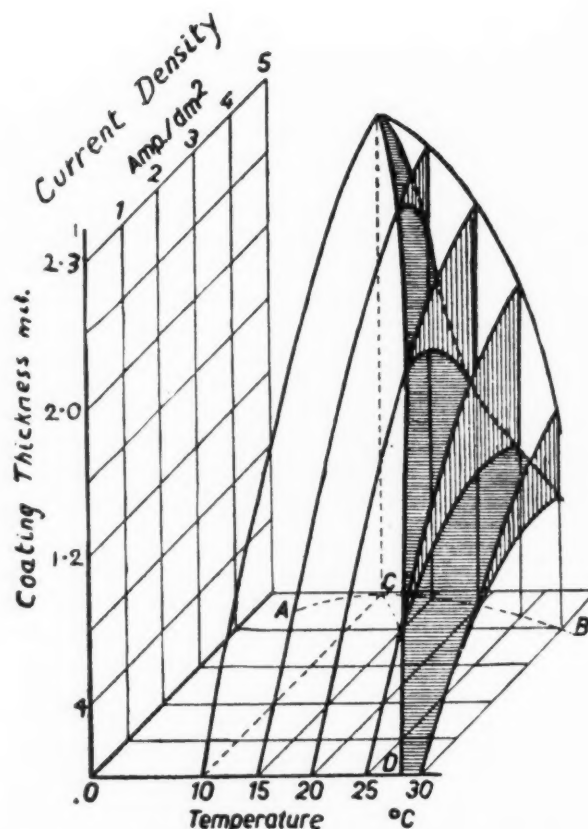


Fig. 2. Anodic-coating thickness produced on an aluminum-magnesium alloy (6.5% Mg) under identical conditions to Fig. 1.¹

concentration, or voltage, or increasing the current density. Of the alternatives stated, both decrease in acid concentration and increase in current density require an increase in voltage, in the former case, by increasing the resistance of the solution, and thus lead to a local rise in temperature at the anode. Cooling the solution itself is, therefore, the principal factor in the production of thick coatings and, due to the local heating effect of the current due to the high electrical resistance of the film, it has in some cases been found best to cool the anode internally.

Tomashov worked with a 20 per cent sulphuric acid solution at 1 to 3°C. and 20 to 50 amp./sq. ft., and during the course of four hours built up oxide coatings on aluminum of 8 mils, using a gradual rise in voltage from 23 to 120 volts as the thickness increased. In the

case of aluminum alloys lower voltages were generally required.

The porosity, too, was found to vary with the alloy composition. Thus, on commercial aluminum, films of 20 per cent porosity were obtained, compared with 35 per cent porosity in coatings in an aluminum—2.2 per cent copper—0.85 per cent silicon—1.25 per cent nickel—0.91 per cent titanium aircraft-piston alloy. The coatings were found to be heat resistant up to 1,500°C. In later work on this process, Tomashov¹³ found that these coatings, as distinct from thinner coatings, were only partially hydrated, and both hydration and porosity was more pronounced at the surface, as shown by a decrease in micro-hardness in the top layers. Film growth in 10 to 30 per cent sulphuric acid at 0.5°C. and 20 to 40 amp./sq. ft. was limited by sparking, and the thickness at which this occurs increased with the acid concentration.

More recently, the production of thick, hard anodic films has been practiced to an increasing extent both in America and in Great Britain, and under the name of "hard-anodizing" it has made possible the use of aluminum alloys in such components as pistons, cylinders and cylinder liners, hydraulic equipment, buffers, gas-turbine-engine components, gears, etc., in which a hard and wear-resistant surface is required. In many of these applications, hard anodizing is an alternative to hard-chromium plating. Compared to the latter, the hard anodic coating is generally cheaper to carry out, presents fewer adhesion problems and will give better oil-retention properties than most types of chromium deposit. On the other hand, hard anodizing is not generally economic where very heavy coatings are to be applied (*i.e.*, thicker than 5 mil and cannot be used indiscriminately on all aluminum alloys.

Production of Thick Coatings

As seen from the discussion of the relationship of operating conditions on the property of the anodic film, the coating thickness is influenced by the solution composition, the bath temperature, the current density and the composition of the alloy. The maximum film thickness obtainable for a given electrolyte increases with decrease in temperature, increasing current density and

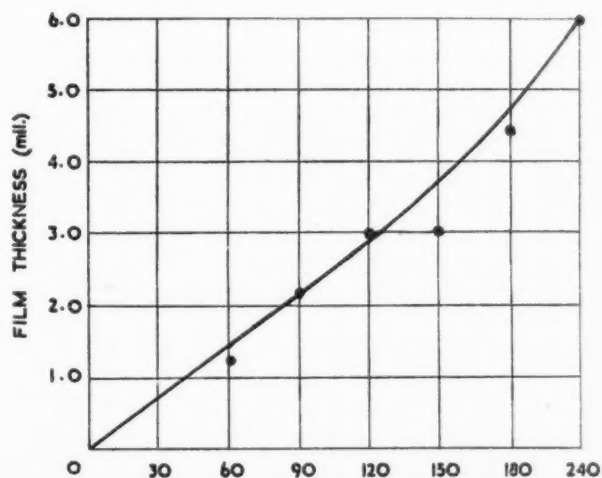


Fig. 3. Growth of M.H.C. hard-anodic coating with time on pure aluminum.

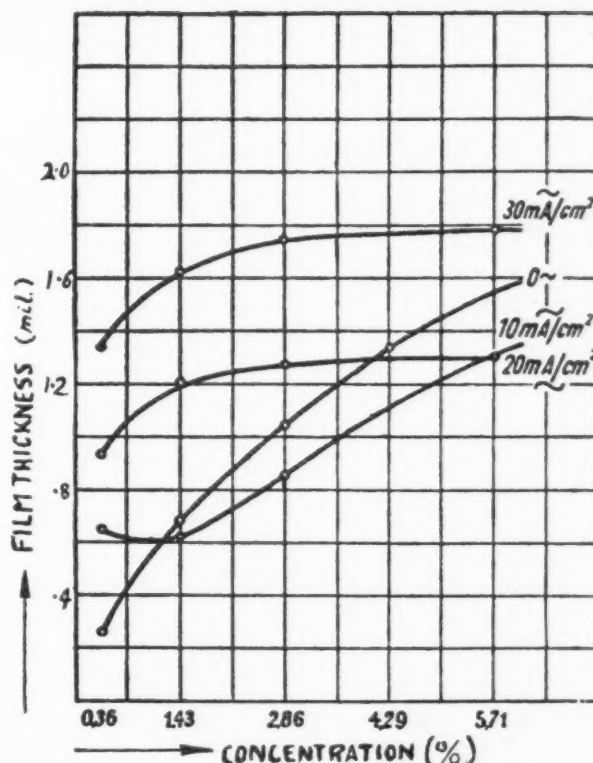


Fig. 4. Growth of anodic coating in relation to oxalic-acid concentration at 60 volts d.c. with varying a.c. component.

voltage, and increasing solution concentrations.

By itself, however, the production of thick films does not necessarily ensure they will be hard. As seen in Figs. 1 and 2¹ at the higher current densities, a soft superficial layer tends to be formed which has a low wear resistance and may, in extreme cases, be powdery.

Recently it has been shown, among others, by Keller, Hunter and Robinson² that increasing the forming voltage may significantly increase not only the thickness of the anodic coating but also its hardness, by increasing the size of the individual cells of which the coating is built up and consequently decreasing porosity. At the same time, the smaller porosity increases the corrosion resistance as does the thicker barrier layer formed at the higher voltage.

Direct-current Processes

A number of commercial hard-anodizing processes have been developed using direct current or superimposed a.c. on d.c.

One of the best known hard-anodizing processes is the M.H.C. process developed by the Glenn L. Martin Co.³ and acquired by the Aluminum Co. of America. This process uses a 15 per cent sulphuric acid electrolyte operated at 20 to 25 amp./sq. ft. and 0°C. To maintain this current density the initial voltage of 25 to 30 volts is increased to 40 to 60 volts and the rate of film growth under these conditions is shown in Fig. 3.

This process is particularly suitable for the production of thick coatings. Where thinner films are required it has been found possible to work at slightly higher temperatures and this has been made use of in a range of alternative processes of the Aluminum Co. of America, called Alumilite 225 and 226 for wrought alloys

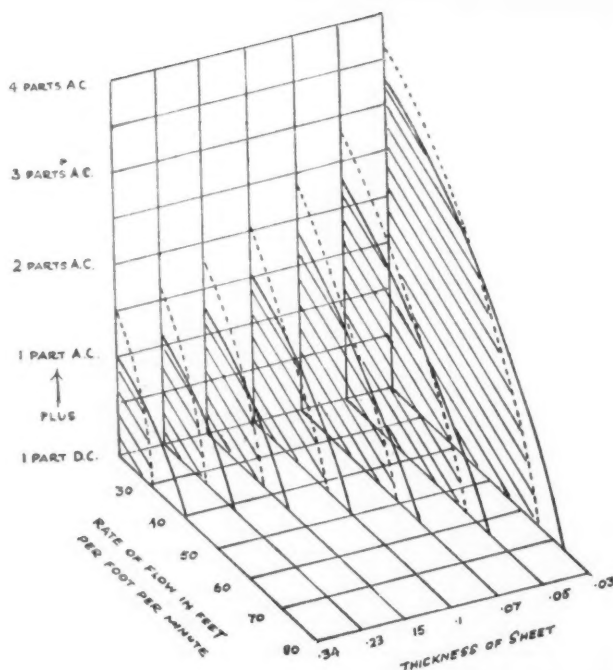


Fig. 5. Diagram showing the relation between sheet thickness, proportion of a.c. component and speed of agitation in the Hardas process. The solid and dotted curves show the relation between speed of agitation (in terms of rate of flow in ft. per min. per ft. of anode surface). When agitation is increased the a.c. can be reduced. The increase of the shaded area to the right represents the tendency for thinner sheet to burn.⁵

and Alumilite 725 and 726 for cast alloys. These processes work at approximately 8 to 10°C. and are used for building up coatings of between 1 to 2 mils in thickness. Limitations associated with the d.c. processes are a tendency to burning unless the anode is provided with efficient agitation and electrical contacts are good. According to Brace,⁴ alloys containing over 3 per cent copper or 7.5 per cent silicon are difficult or impossible to treat by these processes.

Recently a similar process has been made available in England by Alumilite and Alzak Ltd.

Superimposed Alternating Current on Direct Current

As stated by Brace⁴ the development of hard anodizing processes using superimposed a.c. on d.c. was doubtless influenced by Jenny's work with the oxalic acid electrolyte, which showed (Fig. 4) that the use of a.c. will increase the film thickness.

The commercial process using this technique is known as the "Hardas" process and was developed by Campbell⁵ of Hard Aluminium Surfaces Ltd. In varying the a.c. component superimposed on 60 volts d.c. in 6 per cent oxalic acid solution at 4°C., Campbell found that the hardness increased significantly with the amount of a.c., the effect being particularly marked in the outer layer of this coating. Above a minimum a.c. voltage it was found possible also to eliminate initial passivity of the anode, which gave way to rapid dissolution if a certain voltage was exceeded in anodizing with d.c. alone. The use of a.c. also appreciably reduces burning. The magnitude of the a.c. component requirement varies with the alloy composition.

In a sequence described as being used by the Dowry

Equipment Ltd.,¹¹ DTD 130, 410,683 and 300 are stopped off, using wax or P.V.C. type coatings, degreased dipped in 20 per cent sodium carbonate solution and anodized in sulphuric acid (d. 1.10 to 1.30) at -6 to 20°C. at 2.5 to 10 amp./sq. ft. Coatings of 2 mils are stated to be obtained in one hour. The use of superimposed a.c. allows the current density to be doubled without burning.

In this process it was found that the thickest coatings were obtained using a starting voltage of 15 to 20 volts which is gradually raised to 60 to 90 volts. Aluminum sulphate, which builds up during the process, was found to be harmless to a concentration of 300 g./l. After anodizing, the parts are rinsed and sealed at 80°C. The maximum coating thicknesses obtained were 3 to 5 mils at hardness values stated to be 500 to 600 V.P.N. Final lapping, if required, is carried out with a cast-iron plate and diamond dust for 5 sec.

More recently a 10 per cent sulphuric acid electrolyte has been used in this process at 0 to 5°C., and, in this way, it was found possible to obtain films of 2 to 3 mils in 15 min. at rather lower voltages, while an improvement was noted in the treatment of copper-containing alloys.

Cooling and Agitation

As all the hard-anodizing processes are used at low temperatures, cooling is of great importance at the high currents and voltages used. At these temperatures water cooling is obviously not possible and some type of refrigerant must be used. An interesting account on how this problem may be tackled in practice has been published⁶ and describes cooling of a tank at the Grumman Aircraft Engineering Co., operating with approximately 470 gallons of 20 per cent sulphuric acid. In this installation it was shown that two 90-ft. by 1 3/8-in. diameter cooling coils clad with a 3/16-in. coating of lead were sufficient to remove 1.2 million b.t.u. per hour and cool the solution from 32 to 10°C. in 32 min., using "Freon 12" as the refrigerant.

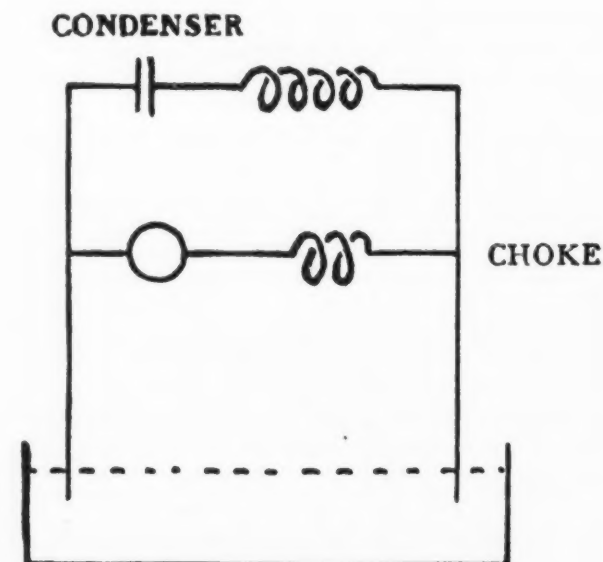


Fig. 6. Small experimental unit suitable for superimposing a.c. on d.c. The transformer in series with the condenser supplies the a.c. The generator in series with the choke supplies the d.c.⁵

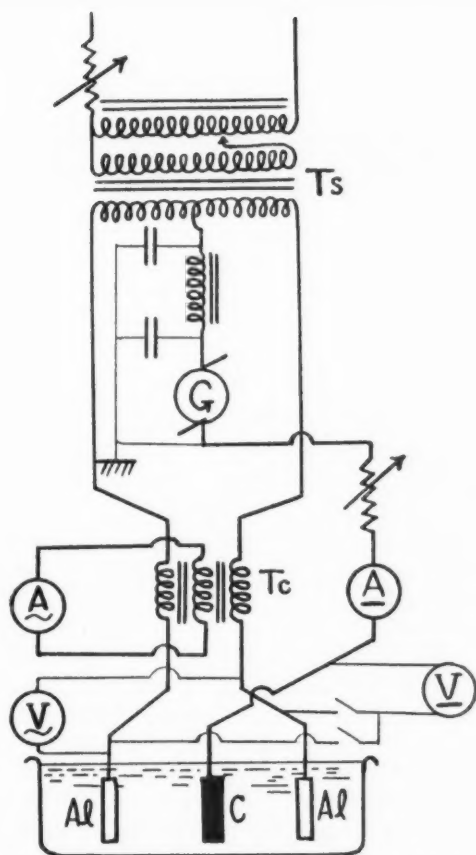


Fig. 7. Circuit used by Tajima⁷ to anodize with d.c., a.c. and superimposed a.c.-d.c.

As heat is produced largely within the anodic coating itself, it is necessary to provide efficient agitation to keep the work at the required temperature. Agitation can be provided either by a paddle or by pumping the electrolyte through an external heat exchanger which thus combines cooling with agitation.

Fig. 5 shows the relationship between the amount of a.c. used, the section of the sheet, and the minimum rate of agitation in ft. per ft. of surface per min.

When agitation is increased, the a.c. component can be reduced without burning resulting. As would be expected, the thinner the sheet the more agitation is required to avoid burning.

Electrical Equipment and Suspension

A d.c. motor generator or rectifier is all that is strictly required for hard anodizing by the d.c. processes. More recently, however, rectifiers have become available which automatically provide for constant current density control, and this use is of obvious advantage in those processes where the voltage must be increased as the film grows.

A number of circuits are utilized for providing the superimposed a.c.-d.c. required for, e.g., the Hardas process.

Fig. 6 shows the circuit used in a small experimental unit.⁵ Here the transformer in series with the condenser supplies the a.c., e.g., in practice up to 60 volts, the whole being in parallel with the generator-choke circuit which should supply between 0 and 60 volts d.c.

A more complicated circuit which can be used for anodizing with d.c., a.c., or superimposed a.c. on d.c. is that described by Tajima *et al.*⁷ (Fig. 7). This circuit has actually been used in a sulphamic-acid anodizing plant.

Even more than in normal anodizing, it is essential to provide good electric contacts in hard anodizing, and clamps and racks must be sufficiently sturdy to keep the work stable in the often swift flow of the solution.

According to Brace⁴ two types of clamp are preferred, the screw pressure type and the bolted lever. With the former, only a minimum area of the clamp should be immersed as, if the screw thread is anodized, the work cannot subsequently be removed without damage to the clamp. The bolted-lever type of clamp may be immersed in the solution more readily, but at least the bolt threads and hinge should be stopped off. Spring clips made from bent flat bar or rod and tightly wired to the anode can be used for small, light articles.

All contacts should be of aluminum or, where this is too weak, in aluminum-magnesium alloy (N5 or N6) or HGWP (a heat-treatable Al-Si-Mg alloy)⁴ may be used. In this case the lower electrical conductivity of the alloys, which in the case of N6 is less than half that of pure aluminum, must be taken into account.

Stopping off is relatively simple. Wax or the usual P.V.C. type compositions or tape used in electroplating may be used. In many cases, however, it may be cheaper to anodize all over. Whether it is cheaper to stop-off will generally depend on the current required for the excess areas or, more rarely, on the appearance, which is a dark grey-green on the hard-anodized surface. As in normal anodizing, clamps should be arranged at hidden parts of the work where possible.

Pretreatment

The normal cleaning operations which apply for normal anodizing should be used, i.e., alkaline cleaning is usually followed by etching in nitric acid before immersion in the anodizing bath. Where dimensional tolerances are close it may be necessary to prepare the work by machining. The component will increase in thickness by something like 50 per cent of the coating thickness. As this, however, depends on the alloy composition and operating conditions, the precise amount will have to be determined by experiment.

(To be continued next month)



Maize Cellulose as a Finishing Material

By William Karr, *Karr & Co., Columbus, Ohio*

About the Author



William V. Karr, President of Karr & Company, manufacturers of maize cellulose, has pioneered the use of this product in the finishing industry. Prior to launching Karr & Company, he served in the United States Air Force and attended Columbia, Vanderbilt, and Ohio State Universities. Mr. Karr now owns and operates most of the mills producing maize cellulose for the plating and finishing

industry and has done a great deal to promote the successful use of this product for drying, polishing, burnishing, and as a filler, carrier, conditioner and absorbent.

ELECTROPLATERS were the first to discover the potentialities of maize cellulose as a polishing agent. The discovery has been the means of developing a new industry; transforming a waste product into a useful and valuable material and stimulating scientific investigation into the uses of the corn (maize) plant.

Maize cellulose was used originally as a drying agent for costume and precious jewelry by New England manufacturers. It was placed in a box-like container together with the articles of jewelry to be dried. The oscillating movement given to the container kept the parts constantly in motion in the meal-like mixture. The high absorbent properties of the medium dried the parts thoroughly and rapidly. Upon examination it was found that a high polish had been imparted to the plated parts with no sign of scratching or staining.

Platers realized that here was an ideal medium. It would dry plated parts and at the same time produce the high polish so desirable for eye appeal. The non-abrasive properties of the cellulose meal were an added incentive.

It is obvious that no one medium or process will be the answer to every problem. In tumbling operations the choice of media will depend upon the desired result. Tumbling is not intended to replace grinding or buffing, but to augment them. In many instances one or more operations may be reduced or entirely eliminated by the use of the tumbling barrel and a suitable medium.

Certain limitations are to be expected. If an abrasive medium is used, metal cannot be removed from one section and retained on another. Sharp edges cannot

be retained while, at the same time, high spots are being removed from the same part. Two or more different types of finishes cannot be obtained during the same tumbling operation.

This general statement is subject to modification when the parts are especially prepared, or when a medium is selected with a specific particle size for a given operation.

Parts can be masked, or suitably protected, to prevent any abrasive or polishing action taking place. Sharp edges and delicate contours can be retained during the tumbling operation by this means.

When interior surfaces have to be protected from the abrasive action, the particle size can be increased so that none of the abrasive particles are small enough to contact the interior surface of the part.

One of the greatest advantages of tumbling, as a means of finishing parts, is the reduction of manufacturing costs. Manual finishing is costly. Wheel and belt finishing are slower in most operations and the number of parts finished per hour, considerably less than when tumbling is employed.

The capacity of the barrel is limited only by its size. The medium and parts to be processed are loaded into the unit. When it is set in motion the parts become highly polished through frictional contact with the medium during the predetermined finishing cycle.

Highly trained personnel are unnecessary. The work proceeds through the specified cycle and when completed there are no rejects. One man can handle a number of tumbling machines or can be engaged in other productive work during the tumbling operation.

The medium should be selected with due regard to the type of finish desired and the metal of which the part is made. High polish is unnecessary and undesirable for a preplating, smoothening operation. It is the main objective, however, after plating and the medium selected should be capable of imparting a high lustre to parts.

Light metals, such as aluminum and magnesium, and soft metals, such as silver, require careful choice of medium to prevent damage to parts during the operation.

Amongst the non-abrasive media in common use today are: Lignum vitae and hard maple shapes, sawdust, scrap leather, leather meal, and maize cellulose.

From Corn Cob to Maize Cellulose

When it was realized that an assured market was opening up in the plating industry, manufacturers of

maize cellulose were encouraged to devote considerable time and effort to research.

Originally, the absorbent properties of the meal had been the desirable factor, but now the polishing action was of equal and even greater importance. It was with this in view that experiments were conducted to endeavor to improve the polishing action while retaining the other desirable characteristics.

The plating industry was unanimous in stating that one of the most desirable properties maize cellulose possessed was its ability to polish without staining a plated finish. This property must be retained.

Maize cellulose is extracted from the ear of the corn cob. The farmer ships his corn to the elevator, or mill. The corn and husk are removed and the cob is shipped to the maize cellulose manufacturer.

Modern manufacturing methods employ machines with corrugated rolls weighing approximately 4,000 pounds each. Five of these machines are necessary to produce a #20 particle size. The machines are designed to give a grinding-shearing action. This produces a particle of irregular shape which has much to do with its efficiency as a polishing medium. None of the absorbency of the meal is lost during manufacturing.

It was found that dust had a detrimental effect upon tumbling operations. The dust, possibly through an accumulation of static electricity, appeared to adhere to the plated parts, so it became necessary to remove the dust. This was accomplished by air suction and filters.

Tramp metal was another problem in the early days of manufacture. Magnets are set up now at various points to extract any fine particles of metal in the meal.

Research indicated that too high a degree of extraction interfered with the polishing action of the meal. It was discovered that the very elements of the corn cob previously considered injurious material, possessed distinctive and desirable properties as a polishing agent. The experiments which followed proved conclusively that this "waste" material acted as a cushion. When retained in the meal a higher lustre was obtained on the plated part and the moisture absorbency was increased.

Maize Cellulose Grit

Grit is another recent development in maize cellulose production. The familiar meal, used so extensively in tumbling operations, is processed in the manner already described. The grit, however, is processed through an attrition mill. This has a compacting effect upon the particles. Thus, a given quantity of grit is much heavier than the same volume of meal.

Microscopic examination indicated that the processed meal, prepared in the conventional way, produced particles of an uneven rectangular shape. When processed in a hammermill the particles became spherical. This formation had a very limited use because many of the desirable features were lost when the edges became rounded. The grit, processed through an attrition mill, was cubical in shape.

This new product has been an important development in tumbling media. Since the introduction of the grit, better results have been obtained. The meal

has a tendency to grip, or cling to a plated part. The grit, on the other hand, appears to rebound from the surface of the part and, probably due to the cubical formation and compactness, lasts longer than the meal in removing oils and chemicals after the parts have been formed. Tests have indicated that the service life of this medium is from three to ten times as great as hardwood sawdust, thereby saving valuable floor space and extra handling.

In many tumbling operations one medium will not give the desired finish and a two stage operation is necessary. The first stage is completed with a tumbling medium designed to produce a given result, such as surface smoothening. A different medium is necessary to produce the high finish so desirable for consumer products.

In the past a compromise has often been necessary due to the labor costs involved in changing the medium. A medium has to be selected which will produce a satisfactory result, but with an inevitable sacrifice in the degree of the final finish.

The careful blending of grit with the meal has permitted the use of one medium for both operations without any loss of brilliance of the finished part.

Air Blasting

Another interesting development is the use of cellulose maize in air blasting operations. The excellent absorbent properties of the meal have been used to advantage in drying operations and in removing grease and oil from parts prior to finishing operations. Cleaning of parts, machinery, and structures was an obvious development from this beginning. This has effected important economies in maintenance work.

The severe abrasive effect of sand blasting limits its use. It has a pitting effect which cannot be tolerated where a surface finish has to be retained. Marble surfaces and the like would be damaged by this abrasion. When the objective is to remove surface grime, dust, dirt and oil without damage to the original finish, air blasting with cellulose maize meal or grit has been found very effective. It has many advantages. The meal absorbs more than three times its weight in moisture. It is non-abrasive and its use does not interfere with the normal plant operations. Machinery is unaffected. When the protective coatings on metal and other surfaces have to be retained and unaffected by the cleaning medium, air blasting with maize cellulose may be the answer.

This unique substance, which at one time presented a serious and costly disposal problem, is finding uses in highly diversified fields. Its cleaning and polishing properties are probably of the greatest interest to the metal finishing field, but related industries are finding other uses for the various types of cellulose maize.

Ball bearings are polished in this medium. Automobile and airplane motors are cleaned. Carbon can be removed from engines without any injurious effect upon the cylinders. The meal is used as a filler ingredient in many paints. The corncob pipe, which was once the major outlet for this waste material, absorbs only 750 tons of corn cobs annually. A million tons are used annually in the preparation of products for industry, medicine, agriculture and consumers.

Stress in Electrodeposited Coatings

Its Significance and Measurement

By Joseph B. Kushner, Director, Electroplating School, Stroudsburg, Pa.

This is Part II of Mr. Kushner's article. The first part appeared in the April issue.—Ed.

IN the first part of this paper we saw that stress is produced in electrodeposits because they shrink or expand and this shrinkage or expansion is restrained by the underlying basis metal. The question is, what makes the deposits shrink or expand? This is the \$64,000 question for which we do not have the answer!

Naturally, there are a number of theories to account for this strange behavior but, as of the present moment, their proponents have not produced sufficient clear cut evidence to prove them. Nevertheless, these theories are of considerable interest. They all delve into the dark jungle of atomic structure wherein are hidden plating secrets of greater import than those of stress. For example, how is a deposit formed? Why are some deposits bright and others dull? Why are some deposits much harder than others? In exploring this almost impenetrable jungle in search of the cause of stress we may find the answer to even more basic plating problems. In order to consider the theories on their merit, however, we should know something about the way that stress is affected by the common plating variables.

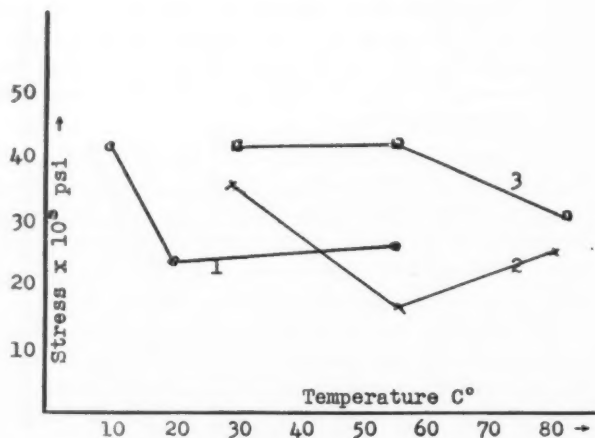


Fig. 10. Variation of stress with temperature of bath (according to Brenner).

1. Watts type bath, .0005" deposit, 20 amps./sq. ft.
2. Watts type bath, .0005" deposit, 50 amps./sq. ft.
3. Chloride type bath, .0005" deposit, 50 amps./sq. ft.

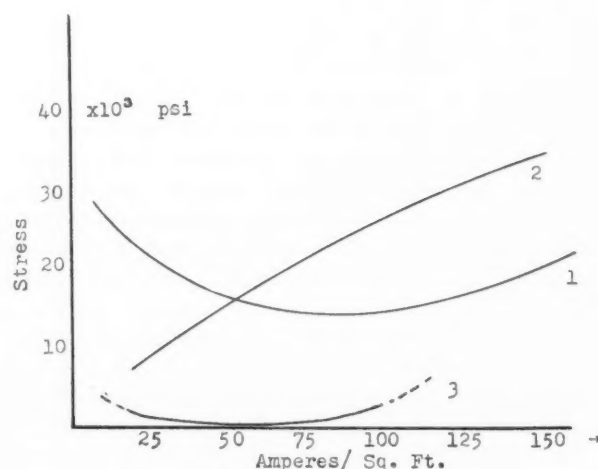


Fig. 11. Variation of stress with current density.

1. Watts type, 131°F., pH 3, Brenner.
2. Watts type, 132°F., pH 2.5, Martin.
3. Sulfamate type, 140°F., pH 4, Barrett.

Effect of Plating Variables on Stress

TEMPERATURE:

In thinking about expansion and contraction, one almost always thinks about temperature effects. We know that heating a metal expands it and cooling it contracts it; can this have anything to do with stress? Heat increases the mobility of atoms; if a stress is caused by their lack of mobility in any way, then it seems logical to suppose that deposits put down at a higher temperature will have less stress in them than deposits produced at a lower temperature. Actual experimental results in this connection are shown in Fig. 10.

The results of Brenner³ show a minimum stress at around 55°C. in Watts type baths. On the other hand, Martin⁴ shows a lowering of stress as the temperature goes up in the Watts type bath. Brenner and others show a lowering of stress in the chloride type bath, as the temperature goes up. Brenner claimed a reproducibility of only 20% in his experiments, whereas Martin claimed a reproducibility of 10%. Apparently, there is a need here for more definitive experiments. If there is a well defined minimum value of stress in

the Watts bath at or about 55°C., how can we account for it? Confusing, to say the least!

CURRENT DENSITY:

If stress has anything to do with crystal structure we would expect, up to a point, that increasing the current density would increase the stress. At low current densities fewer crystal nuclei are formed and these nuclei have the opportunity to grow large, unrestrained by their neighbors, so that a large crystal size results. At high current densities many nuclei are formed; they interfere with each other's growth and a small crystal size results. It seems obvious that the smaller the crystal size the larger will be the stress (everything being equal) if it is due to a volume change, since there will be more restraint from many small interfering surfaces than there will be from a few large surfaces.

Typical results, based on the work of Brenner, Barret⁴ and Martin are shown in Fig. 11. Again, it appears that there is a minimum, somewhere around 70-80 amp./ft.², out of the range of most ordinary nickel plating. Above this value the stress increases with current density, and below it there is also only a slight decrease until we get into the really low region of 5 amp./ft.² or less when the stress increases at a rapid rate. Again we must admit that the results are baffling.

AGITATION:

Agitation of the plating bath in a Watts type solution brings about a lowering in stress. Thus, Heussner⁵ found a stress of 14,000 psi in a nickel solution without agitation. On applying cathode rod agitation, the stress was reduced to 10,000 psi. Evidently there is some connection between agitation and stress but the relationship is rather obscure, since not enough measurements have been made and, at the present time, the amount of agitation is all but impossible to measure quantitatively.

BATH COMPOSITION:

Nickel Content. Brenner, in his work, shows a slight increase in stress as the nickel content of the bath

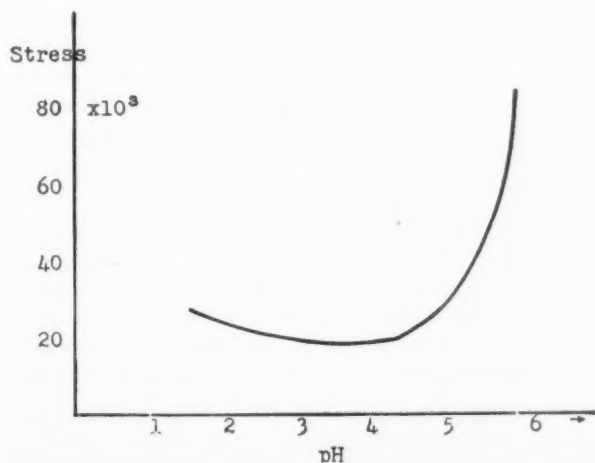


Fig. 12. Variation of stress with pH Watts type bath 131°F.

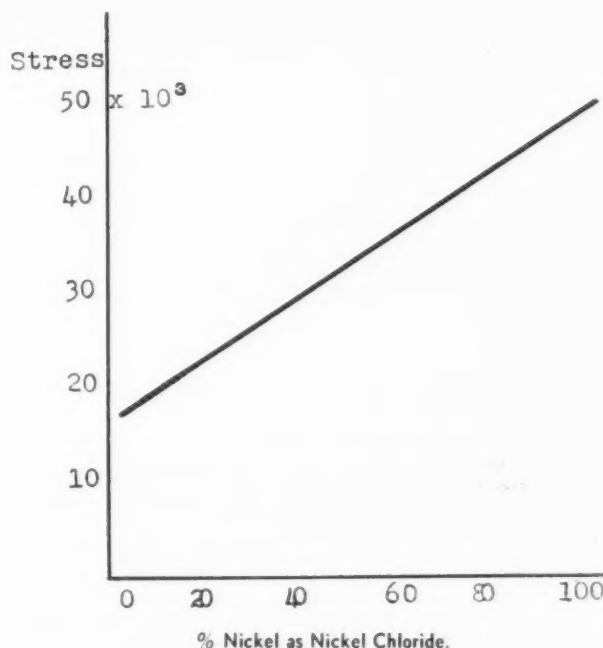


Fig. 13. Increase in stress in nickel bath with increasing chloride content (after Brenner).

increases; Martin shows no significant change in stress with increasing nickel content. Measurements however were made over a rather limited range, i.e. from about 7 to 14 oz./gal. as nickel metal. It seems almost certain that, as the nickel content falls off to a low value, the stress should increase considerably; unfortunately no work has been done in this connection.

pH. The pH of the ordinary Watts nickel bath has an important bearing on stress, as can be seen from Fig. 12. Somewhere in the region between 3.5 and 4.5 the stress is at a minimum value. At a pH below 3.5 the stress gradually increases; above 4.5 the stress markedly increases. The only logical assumption that can be made is that, above 4.5, much more basic matter is being precipitated in the cathode film and, accordingly, more of it is being adsorbed or plated out with the metal. This seemingly points to the hypothesis that stress is, in some way, interrelated with the impurities in the deposit. Yet, there is the odd fact of the minimum value in the range between 3.5 and 4.5. Why should there be a minimum value like this if stress is related to the amount of impurities (basic matter, oxides, etc.) in the deposit?

Anions. The anions that are found in a nickel bath seem to be quite important in relation to stress. In Fig. 11 is shown a plot of stress versus current density for a Watts bath and for a bath made up of nickel sulfamate and boric acid only. The stress in the sulfamate deposit is much less than that in the sulfate-chloride deposit. As can be seen from Fig. 13, increasing the chloride content of an ordinary Watts bath, greatly increases the stress. Why? Much more work remains to be done in this field.

Metallic Impurities. At low pH ranges, ferrous and ferric iron increase the stress in nickel deposits tremendously, aluminum does too but not to such a large

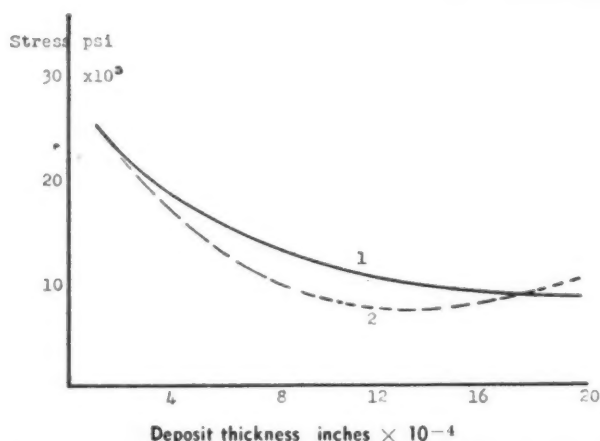


Fig. 14. 1) Average stress in purified Watts bath deposit; 2) Instantaneous stress in deposit (after Brenner).

extent. In the high pH range of operation, iron is no longer a bad actor but chromium is. Why?

Addition Agents. Hydrogen peroxide, the standard anti-pitter for nickel plating, markedly increases stress in the nickel deposit. Only a very small amount is required to oxidize organic impurities in the bath. Anything above this amount enormously increases the stress and makes the deposit susceptible to spontaneous cracking. Organic addition agents may act either to increase stress or reduce it. Most brightening agents act to increase stress; some, however, reduce it. Nickel dibenzene sulfonate and saccharin may completely reverse the direction of the stress in fact, and make it compressive!

DEPOSIT THICKNESS:

Results of several investigations show that the stress in a nickel deposit diminishes as the deposit gets thicker. The relationship with thickness of deposit has the appearance of Fig. 14. At one time it was thought the apparent lowering of stress with increase in deposit thickness was due to the increased thickness making the deposit stiffer, but tests by Brenner⁶ showed that this is not so. He found that the crystal size of the nickel deposit increased as the deposit thickened, and, as the crystal size increased, the stress diminished. With some very clever experiments he proved this to be so. A strip of nickel was electroformed by plating it out on a polished stainless steel surface. The side in contact with the stainless steel had a very fine crystal structure. When nickel was plated out on this side, the deposit showed a high initial stress. When nickel was plated out on the reverse side (see Fig. 15) which had a much coarser crystal structure, the deposit had a much lower initial and final stress. The nickel solution used to put down these deposits was the same one used to electroform the nickel strip.

Photomicrographs of the electroformed nickel, the stress curve of which was similar to that in Fig. 14, showed that, as the grain size increased, the stress diminished. However, it must be remembered that, while the two phenomena were shown to be related in some way, it is not necessarily a mother and child relationship; it could be that the two are only brother and sister and the mother of the two has yet to be discovered!

Average and Instantaneous Stress

The value of stress as determined by the three methods described in the final section of this paper is always the average value of the stress as it exists in the plated layer of metal. It is of interest to know what the stress is in each incremental layer as the deposit is put down. This is called the instantaneous stress. The instantaneous stress can be determined fairly readily but with not too high an accuracy, by a method proposed by Brenner which makes use of the slope of the average value stress curve. The instantaneous value curve as plotted (see Fig. 14) shows that the stress in each layer of the metal as it is put down, gradually diminishes until it reaches a minimum value when the total deposit thickness is about 0.001", after which it increases again. This minimum value seems to be anomalous since it would mean that the grain size of the deposited metal in this particular layer would be larger than that in any other layer, and this was not found to be so. Brenner explains it on the basis of a binding error in the instrument he used for measuring stress or, possibly, in the fact that there is some stress producing effect connected with the initial formation of the deposit which is relieved after a short period of time. In any event, this phenomenon of a minimum value in the instantaneous stress should be studied with more care.

So much for the experimental results. Now for the theories. There are a number of theories which have been proposed to explain the origin of stress in electroplated coatings. We will discuss three of these, (1) the *Excess Energy Theory*, (2) the *Hydrogen Theory* and (3) the *Hydrate Theory*.

The Excess Energy Theory

Since, as was seen in part I of this paper, electrodeposits act in the same way that heat and cold do on the outer layers of a metal in producing stress, an obvious thought is that of relating the shrinkage or expansion of the deposit with the energy possessed by it. Thus, for example nickel, which always contracts under normal conditions, has a high overvoltage. Since this overvoltage (not to be confused with hydrogen overvoltage) represents the energy in excess of the true equilibrium value required to cause electrodeposition, the nickel plate at the time it is deposited must possess this extra energy. This means that the lattice must be expanded at the time the plate is put down or that the atoms are in an unstable state. There is then a conversion to the stable state in which the nickel atoms lose their excess energy. The lattice shrinks to its normal size and, as a result, a residual tensile stress is set up in the deposit.

The unstable state theory was first proposed by Glasstone in 1926 to account for the relatively high metal deposition overvoltage found only with cobalt, iron and nickel (0.20 to 0.30 volts). Graham and Soderberg⁷ expanded it to account for the tensile stress normally found in deposits of these three metals.

To put the idea in terms of heat, the nickel deposit acts as though it were being plated out at a considerably higher temperature than that of the plating bath. Immediately after being put down, the deposit loses

this excess heat and shrinks to normal size.

The Excess Energy Theory is bolstered by these facts: (1) Work by Barklie has shown that stress in nickel deposits increases linearly with metal deposition voltage. Since this means increased overvoltage and, thus, higher energy at the time of plating out, the increased stress is naturally accounted for. (2) Other investigators have shown that superimposing alternating current on the direct current used for plating out nickel considerably reduces the stress in nickel deposits. Since it is well known that deposition overvoltage is reduced by such plating methods, we have here another straw in the wind.

Unfortunately, however, there are several flaws to the theory and much research must be done to find the answers. For example, how does it explain that a nickel deposit can be "sanforized" by the addition of certain compounds such as saccharin to the plating solution? That, in fact, some compounds cause the deposit to become compressive in nature? Can it be that these compounds lower the deposition overvoltage to the equilibrium value or lower? In other words, with these compounds present, nickel is deposited at a lower temperature than that of the surrounding plating bath. It hardly seems possible! Something like this would have to be demonstrated if the theory is to hold water. Again, how to explain the fact that the presence of chloride ions increases the stress in nickel deposits? Certainly, when it comes to metals outside of group VIII, such as cadmium and zinc, which expand when deposited, the theory does not appear capable of logically explaining the situation, at least as of this moment.

The Hydrogen or Hydride Theory

This theory at first found fairly wide acceptance, but has since been discredited. It holds that, at the time of plating, some hydrogen is deposited in the lattice, probably as a nickel hydride. This, naturally, expands the lattice. Shortly thereafter, the hydrogen is released from the lattice by a diffusion process and the nickel lattice now shrinks to normal size, thus setting up a tensile stress in the deposit. This theory found support in the fact that certain depolarizers (in this case substances which inhibit or retard the deposition of hydrogen) act to reduce stress. It also found support in the fact that superimposed AC current helped to reduce the stress, because it could be argued that, on the reverse cycle, some of the hydrogen that would normally go into the lattice was oxidized back to water.

However, this theory does not explain the presence of contractile stresses in copper and silver deposits which are plated out at 100% cathode efficiency (or very nearly so) and compressive stresses in zinc plates deposited at cathode efficiencies much lower than 100%. Neither does it explain the startling effects of certain substances in diminishing or magnifying stress. For example, it cannot explain the large effects of impurities such as iron, carbon dioxide, manganese and aluminum, in increasing stress.

Wylie⁸ proposed an interesting variation of this theory to account for stress. He proposed that there are two distinct mechanisms at work causing the deposi-

tion of metal: (1) Gain of electrons from the cathode and (2) reduction by hydrogen atoms. Metal atoms that may be formed by hydrogen reduction deposit between the metal nuclei formed by electron gain—in a sense shouldering them apart as they do not conform to the crystal structure of the electrodeposited metal crystals. This accounts for the compressive stress found in the non-transition metals such as zinc and cadmium. With the transition metals little hydrogen reduction takes place. Instead, hydrogen diffuses into the metal lattice as described previously and, on diffusing out, shrinkage of the lattice accounts for the tensile stress.

In spite of the fact that free energy calculations show that it may be possible to reduce some of these metals with free hydrogen at ordinary temperatures, there is no evidence that these metals exist in other crystalline forms in the deposits, other than those produced by electrodeposition. Likewise, it does not explain the remarkable effects on stress produced by small amounts of impurities.

The Hydrate or Basic Oxide Theory

J. B. O'Sullivan⁹ proposed a hydrate theory to explain the cause of stress in electroplated coatings. He suggested that a hydrate of nickel is codeposited or adsorbed by the nickel deposit at the moment of plating out. As the plating continues, this hydrate is reduced or partially decomposed so that, now, shrinkage of the lattice ensues causing a tensile stress to develop.

This theory was further elaborated on by Hother-sall¹⁰ to explain the formation of expansive deposits. In the case of zinc, for example, he proposed that the hydrate formation increases *after* the zinc is plated out. This forces an expansion of the lattice and a compressive deposit results. He further proposed that, when a hydrate is reduced by hydrogen, the reaction is rapid, whereas the taking on of water or the loss of water might be slow processes.

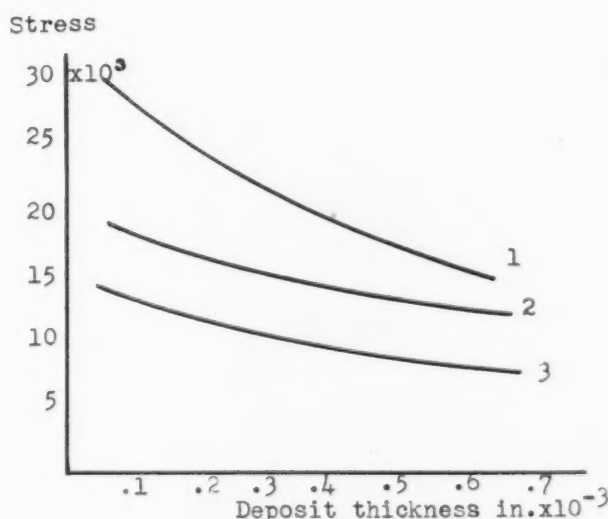


Fig. 15. Variation of stress with thickness

1. Plated out on stainless steel.
2. Plated out on electroformed nickel, bright (fine grain) side.
3. Plated out on electroformed nickel, dull (coarse grain) side.

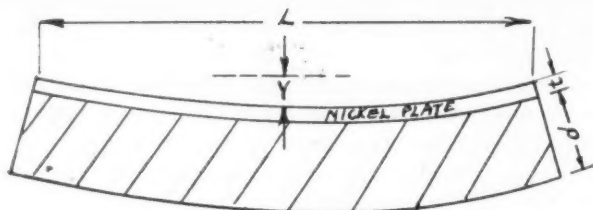


Fig. 16. Stoney deflection method for determining stress (deflection exaggerated).

Brenner³ and others found oxygen and hydrogen in nickel deposits and also found in certain cases that, as the stress increased in the nickel deposit, the oxygen and hydrogen content of the deposit likewise increased. Brenner feels however that stress in deposited metals may be caused by a number of different factors.

The hydrate theory has some attractive features. Certainly, we know that the cathode film is always on the basic side. Since this is so, metallic hydroxides are bound to form to a certain extent. Metallic hydroxides are colloidal in form very often and are capable of being adsorbed or, as colloidal particles, may have an electric charge and can thus be electrodeposited on the cathode. Many of these compounds form hydrates which are stable at high temperatures. The action of addition agents and certain ions on stress may be explainable by their effect on the degree of hydration.

Much research work remains to be done on the cause of stress in electrodeposits.

Methods for Measuring Stress

The first quantitative measurements of stress in electroplated coatings were made by Mills¹¹ in 1877. He silvered the glass bulb of a thermometer and plated out nickel on it. The nickel, in contracting, exerted a pressure on the mercury well and squeezed some of it

up into the thermometer stem above what the normal height would be for the surrounding temperature, as established by a similar, unplated thermometer. He converted this squeezing effect or "electrostriction" as he called it, into pounds per square inch, by placing the bulb of the unplated thermometer in a pressure tank and noting what pressure was required on the bulb to bring the reading up to that produced by the nickel plates. In this way he was able to get some quantitative values of the stress in deposits of silver, copper, zinc and cadmium as well as iron and nickel.

While the method is of historical interest, it has never been used since, because of its lack of practicality and the fact that the nickel and iron formed cracks at an early stage due to the small radius of curvature, thus completely invalidating the results.

The second method used and one that has been the basis of all other practical methods since is the deflection method as originated by Stoney.¹²

As illustrated in the diagram (Fig. 16) with this method one side of a long thin strip of metal such as steel is plated with the metal to be tested. In the case of nickel, which is in tensile stress, the metal strip deflects in such a way that the nickel deposits is on the concave side. Treating this as a simply loaded beam problem, Stoney solved it for the stress in the nickel layer in terms of the deflection, the thickness of the deposit, the thickness of the metal strip and the length of the deposit. The formula which he derived was:

$$S = \frac{4Ed^2Y}{3tL^2}$$

where E is the modulus of elasticity of the metal strip, d is the thickness of the metal strip, t is the thickness of the deposit, L is the length of the plated portion of the strip, and Y is the deflection at the center in inches.

This equation was derived on the basis of the plate being considerably thinner than the metal strip. Where the deposit is thicker, he gave as the result:

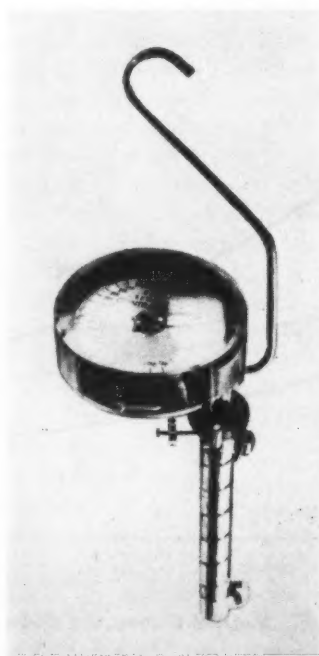
$$S = \frac{4E(d^2 + td)Y}{3tL^2}$$

A number of variations of this method have been developed in which the deflection is measured at the end instead of the center of the strip, or in which the deflection is magnified by an optical or mechanical means. The most ingenious of these is the Spiral Contractometer, developed by Brenner and Senderoff in 1948, in which the strip is coiled in the form of a spiral. The deflection at the end of the spiral is transmitted by means of a magnifying gear train to a needle on a dial (Fig. 17).

This gives the angular deflection in radians. The spiral, which is usually made of stainless steel, is calibrated by means of a torque produced by a standard weight.

The formula for the Spiral Contractometer is based on the Stoney formula with the radius of curvature taking a different value from the simple one it has in the beam formula.

$$S = \frac{K'D'}{t}$$



(Courtesy Kameras Instruments, Chevy Chase, Md.)

Fig. 17. Brenner-Senderoff spiral contractometer.

where S is the stress in psi, K' is the deflection constant of the spiral equal to M/D'' where M is the bending moment produced by the standard weight and D'' is the deflection on the dial produced by the standard weight, D' is the deflection on the dial produced by the deposit and t is the thickness of the deposit.

In 1954 the author¹⁴ developed an instrument for measuring stress in electrodeposits, called the Stresometer. In this instrument, illustrated in Fig. 18, a simple thin removable metal disc acts as the roof of a shallow chamber containing a metering fluid. This chamber is, in turn, connected with a precision bore capillary tube. When the outside of the disc is plated with a metal in contractile stress, the disc is forced to dish in, which causes the liquid in the capillary tube to rise as the pressure on the fluid in the chamber is transmitted undiminished by Pascal's Principle. If the metal plated out is in compressive stress, the disc bulges out and the liquid in the capillary falls. The rise or fall of the liquid in inches is a direct measure of the stress in the deposit.

The formula for the instrument is:

$$S = \frac{KL}{t}$$

where S is the stress in psi, K is the disc constant, L is the rise or fall of the liquid in the capillary in inches, and t is the thickness of the deposit on the disc. K is determined simply from the known diameter of the plated area of the disc, the thickness of the disc and the rise in the capillary fluid when a known pressure, (produced by the weight of plating solution) acts on

the disc. $K = \frac{QA^2}{4L'd}$, where Q is the pressure acting

on the disc in psi from the weight of the plating solution, A is the radius of the disc, L' is the change in capillary height due to the pressure, and d is the thickness of the disc.

An attempt has been made to measure the stress in electroplated metals by measuring the strain by X-ray diffraction methods.¹³ Since X-rays are reflected back from a crystal lattice in an orderly way depending on the spacing and geometric form, it would be expected that, when a distortion in the lattice occurs due to a strain, this distortion would be reflected in the X-ray picture. This is correct. Lattice strains cause the reflection lines to become more diffuse so that a measure is provided of the amount of strain. Unfortunately, however, in electrodeposits where fine crystal size is also encountered, the fineness of the crystal size produces a similar type of diffuseness, so that it is hard to tell where one effect begins and the other ends. Accordingly, this method is not used practically in measuring this type of stress.

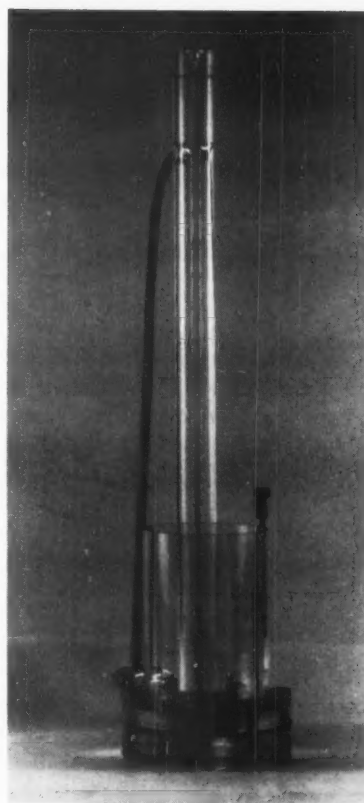


Fig. 18. Stresometer.

A great deal of work must be done yet on stress before a clear picture will emerge. Nevertheless, this lack of theory should not in any way prevent the plater from using stress measurements to his practical advantage. As was pointed out in the first part, plant tests have already shown that, at least in the case of nickel solutions, daily stress measurements are a better diagnostic means for determining the actual working condition of the solution than a routine chemical analysis. This may very well hold for other types of solutions too.

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Analysis of Electroplating Solutions*

Estimation of Boric Acid in the Presence of Nickel and Ammonium Salts

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IN a previous communication from this laboratory¹ a method has been described for the estimation of boric acid in a plain nickel plating bath, i.e., one which does not contain ammonium salts or fluorides. Some solutions contain in addition, ammonium salts, and the estimation of boric acid in the presence of these present some difficulty as an error is introduced by the fact that ammonium compounds tend to dissociate in the region in which the titration of the mannitol-boric acid complex is completed.²

In normal practice, interference due to the ammonium salts is avoided by removing the latter by boiling the solution with alkali³ before the determination of boric acid; this serves the two-fold purpose of removing nickel by precipitating it as the hydroxide and of decomposing the ammonium salts. Boric acid is estimated in the filtrate by the usual methods. Boric acid is also separated by distillation. These methods are both time consuming and laborious and are not suited for routine determinations.

Other methods for destroying the ammonium salts are the following:

(1) By treatment with hypobromite solution, when the ammonium salts are oxidized to nitrogen:⁴
 $2\text{NH}_4\text{Cl} + 3\text{NaBrO} \rightarrow \text{N}_2 + 2\text{HCl} + 3\text{NaBr} + 3\text{H}_2\text{O}$.

(2) By treatment with formaldehyde according to the method of Sorensen,⁵ when a weak base hexamethylenetetramine ($\text{Kb} = 8 \times 10^{-10}$, $\text{pK} = 9.1$) is obtained:



As may be seen, in either of the above cases, an amount of acid equivalent to the ammonium salt is developed.

It was originally planned to combine the two methods in such a manner, that the hypobromite method may be used for the determination of ammonium salts, and the formaldehyde method employed for the determination of the total acids (liberated from the ammonium salts by treatment with formaldehyde, and boric acid). The hypobromite method was not found to be applicable in the presence of nickel salts as an indefinite amount of the latter are also oxidized⁶ to the higher valency state thus falsifying the ammonia determination.

In the following communication, a method has been developed for the determination of boric acid by the formaldehyde method in the presence of nickel and ammonium salts and the factors affecting these determinations have been explored. In brief, the method consists in adding to the solution containing nickel,

ammonia and boric acid, an excess of formaldehyde and potassium oxalate and titrating to a definite pH value, when any free acid already present or that obtained from the ammonium salts is neutralized. At this stage, mannitol is added and the titration is continued, the amount of alkali consumed in the second stage being noted.

The total acids, including the free acid liberated in the formaldehyde process as well as the boric acid, should normally behave like a mixture of a strong and a weak acid and it should theoretically be possible to determine each of these acids separately. In practice, however, there are limitations. The end point obtained with the acid developed from ammonium salts is best judged at pH 6.7.⁷ Normally boric acid dissociates but little in the pH range in which the titrations of the strong acid would be completed, but it has been shown that the presence of nickel and other metal ions⁸ affects the dissociation of boric acid. Thus there is a likelihood of an overlap at the intermediate point due to the incomplete neutralization of the acid liberated from the ammonium salts and the partial dissociation of boric acid.

In the following investigation various factors affecting these determinations have been explored.

Experimental

The following solutions were used:

Nickel chloride	47.27 g./l.
Nickel sulphate	52.57 "
Ammonium chloride	7.5 "
Ammonium sulphate	7.5 "
Boric acid	12.5 "
Caustic soda solution standard ...	8 "
Potassium oxalate	184.23 "
Formaldehyde	C.P. grade 37%
Mannitol	10% solution.

Phenolphthalein: (For convenience referred to as indicator P). 1% in alcohol water.

Methylene blue-methyl red indicator.

Bromothymol blue-phenol red-sodium salts:⁹ 0.1% each in water (pH range 7.2-7.4-7.6) (adjusted to pH 7.2). For convenience this is referred to as Indicator BB-PR.

In the actual determination, aliquot volumes of nickel (chloride or sulphate) solution, ammonium (chloride or sulphate) solution and boric acid are mixed and boric acid is determined by any two of the following alternative procedures:

(1) This procedure involves a single titration.

* Reprinted from *Electroplating*.

After addition of solutions of potassium oxalate and formaldehyde, the mixture is heated nearly to boiling and rapidly cooled. A few drops of bromothymol blue-phenol red indicator (BB-PR) are added and standard alkali added followed by a vigorous shaking. The titration is continued to the point when blue colour just appears in the solution (Stage I).

From this point onwards the titration with alkali is continued. The color of the solution passes through a distinctive deep blue (Stage II). It is followed by addition of phenolphthalein and titration to a violet end point (Stage III). The requisite quantity of mannitol is added, followed by titration with alkali till the appearance of a violet end point (Stage IV). The volume of alkali consumed between stages I and IV gives the equivalent of boric acid. Usually it requires a good deal of practice to judge accurately the points at stages I and IV.

(2) *This procedure involves two separate titrations.*

- (a) To an aliquot of the mixture are added complexing agents, i.e., formaldehyde and potassium oxalate. The solution is heated to boiling, cooled and the whole is titrated with alkali, using BB-PR indicator, and the end point noted corresponding to the appearance of a deep blue color (see Stage II, above).
- (b) Another portion is titrated in presence of potassium oxalate, formaldehyde and mannitol using phenolphthalein as indicator and the end point is noted by the appearance of a violet tinge in the solution.

The difference of volume of alkali consumed between the two above operations gives an amount equivalent of boric acid.

To determine the extent of overlapping, etc. separate titrations were run to find out the alkali consumed with the following combinations:

- (1) Nickel (chloride or sulphate) and ammonium (chloride or sulphate).
- (2) Nickel (chloride or sulphate) and boric acid.
- (3) Ammonium (chloride or sulphate) and boric acid.

In each of these cases, the end points were determined at the usual pH levels: (i) the appearance of just blue color with bromothymol blue-phenol red indicator after a prior addition of potassium oxalate-formaldehyde, and (ii) the phenolphthalein end point after an addition of mannitol to the above.

Summary and Discussion of Results

(1) The total amount of acid liberated from the ammonium salts is not completely neutralized at pH 7.2 (stage I with BB-PR indicator). Apparently the titration has to be carried into the phenolphthalein range for completion.

(2) The ionization of boric acid does increase appreciably in the presence of nickel salts but the value of the titre in the region covered by BB-PR stage I is of the order of 2% with 25 ml. of nickel salt and 10 ml. of boric acid. For example, it requires 0.2 ml. of alkali, which is of the same order as that required

for ammonium salts after BB-PR stage I end point. It is thus suggested that there is a possibility of a mutual cancellation of errors and a consequent natural adjustment of the alkali titre for boric acid.

(3) When all the three ingredients, i.e., nickel and ammonium salts and boric acid, are present, they affect the titre of ammonium salt slightly.

(4) The titre for boric acid as determined by either of the aforementioned procedures, i.e., single titration or double titration methods, is slightly high when only low concentrations of the acid are present but approaches the expected figure at higher concentrations of boric acid.

These determinations have been carried over widely varying concentrations of the ingredients, and it has been concluded that, when salt and boric acid are present in the molecular ratio of 5:1, the figure for boric acid is high by about 5% but, when the molecular ratio between nickel salt and boric acid varies between 2:1 and 1:2, the values tend to be reasonably correct. It may be safely concluded that the values for boric acid obtained are correct within $\pm 2\%$ in the range of concentrations met with in normal practice.

In view of the fact that determinations of boric acid can be carried out extremely rapidly, the method is considered to be an improvement over the methods used hitherto requiring the separation of boric acid by distillation or other methods. It is our practical experience that an average set of three titrations can be carried out in less than 15 minutes and, that the time required for any attendant preparations is only about 10 minutes whereas the distillation method requires on the average three to four hours. In view of the great simplicity of the method, it may be easily adopted for routine control determinations.

Further work employing electrometric methods is in hand and the results will be reported as soon as available.

Acknowledgment

Our thanks are due to the Director, National Physical Laboratory of India, for his kind permission for the release of the paper.

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Finishing Pointers

Adjustment of Bath Voltage by Fixed Resistance

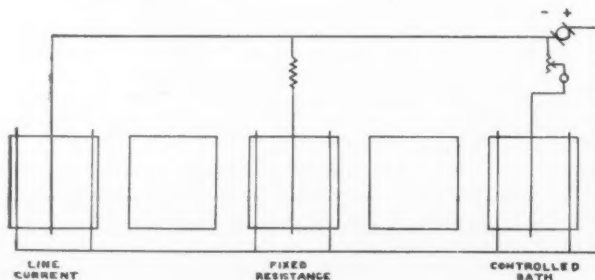
By J. B. Mohler

THE ideal situation for usage of current on an electroplating line is to have a separate current source and separate controls for each tank. Although this may assure good control it cannot always be justified as the most economic arrangement. There usually is no serious objection to operating a cleaner, electropickle or strike from the same source as the plating tank. The control of current in the preparatory tanks is not critical and, if the plating tank is equipped with controls and a sufficient total current source, the use of current at the other steps will not seriously interfere with plating. It is common practice to use one current source to service an entire plating line.

At times a processing step is placed in the line that requires control in order to avoid exceeding the limiting current density. An electrocleaner or a strike in the line requires at least 6 volts at the current source. If a nickel plating step is placed in the line the voltage will then be too high to use nickel as a processing step without control. Such a situation can be taken care of by the use of a fixed resistance.

In order to estimate the value of the fixed resistance several measurements or several assumptions will have to be made. What is desired to be known is the voltage and amperage requirements for the fixed resistance. The voltage across the nickel bath will be 2 to 3 volts and the voltage drop in the line will be about 1 volt. These should be measured if possible. The current will be the operating current density of the work times the total area to be plated.

If the voltage at the current source is 6 volts then the fixed resistance voltage will be about $6 - 3\frac{1}{2} = 2\frac{1}{2}$. If the plated area is 5 sq. ft. at 20 A.S.F. then the current will be 100 amperes.



The fixed resistance will be:

$$R = \frac{E}{I} = \frac{2.5}{100} = 0.025 \text{ ohms}$$

From wire tables or by measurement a wire should be selected that is sufficiently heavy to carry 100 amperes and sufficiently long to have a resistance of 0.025 ohms.

The wire is placed in one of the leads to the bath and may be remote from the bath as long as it is in series with the bath and in parallel with the other tanks, as indicated in the sketch.

Heavy resistance wire is good to make a fixed resistance. Such a wire may be quite hot when it is in use so it should be placed in a location where the heat will not be a hazard or will not cause damage.

There will still be some control over a tank using fixed resistance, since the current source is usually variable. Since the variable current source will have little effect on a cleaner or a strike and since the plating tank will be controlled, the current can be varied at the source to obtain the best results at the desired processing tank.

The use of a fixed resistance is an expedient that is often used when instruments and rheostats are not available and it is necessary to control an extra tank from one current source. If such a scheme is overworked it can result in complication of a circuit and loss of flexibility of control. Such can happen by the use of fixed resistances in more than one place in a line. In such a case a change at the current source will effect more than one tank with a change in the fixed resistance the only method of control. It will then be definitely desirable to have variable resistance.

If the use of a fixed resistance is well worked out, well constructed, and tested by use, there is no reason why it cannot be used to economic advantage as permanent equipment. It really amounts to the equivalent of a tank rheostat with only one tap. And there are many tank rheostats that are set and used as fixed resistances for long periods of time. In fact, if a fixed resistance can be used, it may be of advantage in that it takes one variable out of the process.

For confidence in performance of the fixed resistance and for minor control it is advisable to use an ammeter in series so that the consumption of current can be observed.

The fixed resistance will be most successful where changes in the bath are not great and where changes in the work area are not great. Small changes in the bath will only have a minor effect. Reasonable changes in the work area will not result in great changes in current density. If the anode area is sufficiently large, the total current will be approximately proportional to the cathode area, so that doubling the work area will approximately double the total current with little change in current density.

Finally a bath that is used as a process bath or as a flash plating bath has sufficient range that loss of control due to the use of a fixed resistance will not be serious.

Science for Electroplaters

14. Electric Circuits

By L. Serota

ELECTROPLATING is concerned with an electrochemical process whereby electrical energy is converted into chemical energy. Such operations as electrocleaning, electropolishing, electrodeposition and anodizing are functions of this energy change. The principal source for the electric power utilized in these processes is the generator which changes or transforms mechanical energy into electrical energy. The burning of fuel such as coal, oil, or gas is one method for providing this mechanical energy. Water power, however, is becoming increasingly important as a source for the mechanical energy, which is converted to electricity by means of electric machines. The future holds great promise for the utilization of atomic energy for conversion to this convenient form — electrical energy.

Electric power may also be obtained from a battery such as a dry cell or storage battery. In such units, chemical energy is transformed into electrical energy.

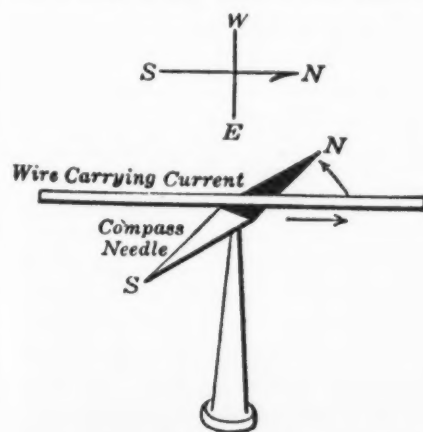


Fig. 37.

cal energy. For example, two dissimilar metals such as copper and zinc, when immersed in a water solution of an acid or salt, represent a system that will serve as a source of electricity. This source was discovered by Alessandro Volta over a hundred years ago and is referred to as a *voltaic cell*. If the metals are connected externally by a wire, a continuous source of electricity is made available.

The following effects will occur: A magnetic needle placed near the wire will be deflected (Fig. 37); the wire becomes warm; if the wire is divided and the ends placed in a solution of an acid or a salt, chemical action, discernible by the liberation of a gas or deposition of a metal, will result. The effects observed, magnetic, heating and chemical (Fig. 38), are believed to be caused by the flow of a current of electricity which is carried through the wire (metal) by electrons. The zinc plate in this cell becomes the

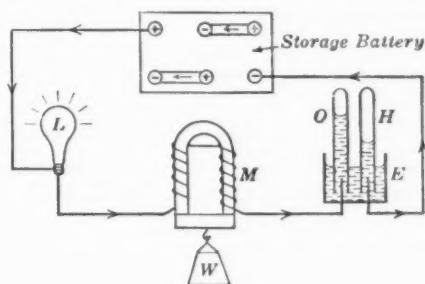


Fig. 38.

negative terminal, because some of the zinc enters the solution and changes to the positive zinc ion, Zn^{++} . The electrons remaining when this ionic change occurs provide the negative charge for the zinc terminal. The copper plate acts as the positive terminal, attracting the free electrons that flow through the wire.

Fig. 39 is a diagrammatic representation of a voltaic cell with sulfuric acid, H_2SO_4 , as the conducting solution (electrolyte). The conventional designation of current flow was arbitrarily chosen to be from the positively-charged body to the negatively-charged body (positive to negative). The actual direction of electron flow (or current of electricity), as indicated in the diagram, is from negative to positive.

If two or more of these voltaic cells are connected so that the zinc terminal of one cell is connected to the copper electrode of the second cell and so on, the external circuit will show a proportionate increase in magnetic and chemical effects. The cells, when so

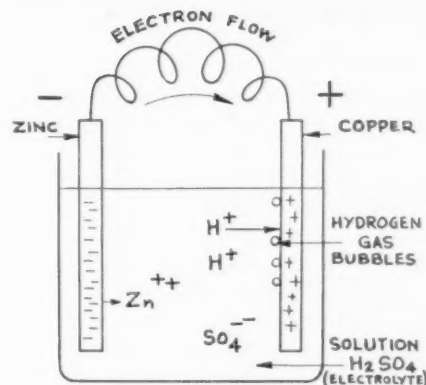


Fig. 39.

connected (in series), will have an increased electrical force or pressure which drives the electric current (or electrons) through the wire. This cell pressure is known as the electromotive force (*emf*) or voltage and represents the potential difference between the terminals of the cell. The *emf* of a single cell is between 1 and 2 volts. The dry cell and storage battery are examples of such current source.

The current flow in a circuit is dependent on two factors. One is the pressure or *emf* of the cell which provides the current; the other is the resistance which regulates the current flow in the circuit. The unit for measuring current is the ampere. Resistance is measured by the unit called the ohm.

An ampere represents a quantity of electricity (a coulomb) that will flow past any given part of a wire in one second. A coulomb is equal to approximately 6 billion billion (6×10^{18}) electrons. Such rate of flow, a coulomb per second, constitutes a current of one ampere. For example, the heating element in a toaster will take a current of about five amperes. This means that five coulombs, or five times 6 billion billion (30×10^{18}) electrons are being transferred each second. By international agreement the ampere is defined as the quantity of electricity which will cause the deposition of 0.001118 gram of silver from a silver solution when flowing for one second.

Ohm's Law

Metals and most alloys are generally good conductors of electricity and offer very little resistance to the flow of an electric current. Silver is one of the best. Passage of electricity through the metal conductor is caused by free electrons. Such electrons are not firmly bound to the nucleus. Materials such as wood, paper, glass, rubber, with few

free electrons, offer a high resistance to current flow and are classified as non-conductors or insulators. That property of a material whereby the flow of an electric current is retarded is known as electrical resistance. The practical unit for such measurements is the ohm. A wire has a resistance of one ohm when a pressure of one volt will force a current of one ampere through it. If the pressure is one volt and the resistance is one ohm then one ampere current flows. If the force is two volts and the resistance remains one ohm, then two amperes of current flow. A force of one volt and resistance of one-half ohm means a current of two amperes. The international ohm is defined as the resistance at 0°C. of a column of mercury 106.3 centimeters long, one square millimeter cross-section, weighing 14.4521 grams. An iron wire of similar dimensions (the weight of course will be different) will have a resistance of about a tenth of an ohm. Resistance of a wire (conductor) will depend upon a number of factors such as: the material, size or cross-sectional area, length, temperature.

Ohm's Law may be represented as follows:

$$\text{current} = \frac{\text{pressure}}{\text{resistance}}$$

or

$$\text{amperes (I)} = \frac{\text{volts (E)}}{\text{ohms (R)}}$$

Examples:

1. A generator for a plating unit provides 6 volts. If the resistance of the circuits is 0.2 ohm, what current may be obtained?

$$\text{amperes} = \frac{\text{volts } 6}{\text{ohms } 0.2} = 30 \text{ amperes}$$

2. How much current will flow through a bus bar, resistance 0.003 ohm, if a pressure of 1.8 volts is applied.

$$I = \frac{E}{R} = \frac{1.8}{0.003} = 600 \text{ amperes}$$

3. A dry cell has terminal voltage of 1.2 volts. If a small lamp having a resistance of 3 ohms is connected by wires, across the terminals, what current will flow?

$$I = \frac{E}{R} = \frac{1.2}{3} = 0.4 \text{ ampere}$$

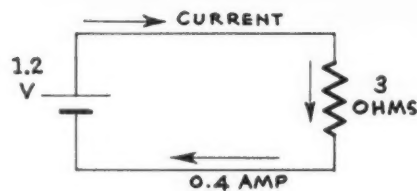


Fig. 40.

Electrical circuits may be conveniently represented diagrammatically. The terminals for a cell are indicated by a long drawn line for the positive (+) electrode. A heavier short line represents the minus or negative (-) pole. Resistance is represented by a zig-zag line (Fig. 40).

Measurement of Current

Measuring the flow of current in a circuit is usually likened to measuring the current flowing through a pipe. A water meter or flow meter inserted in the pipe will indicate the number of gallons of water flowing through the pipe each second. In a similar manner, a current meter inserted in an electric circuit will indicate, in amperes, the electric current flowing through the line. Such an instrument is called an ammeter (ampere-meter). Since the current flowing through the circuit must also pass through the meter, the instrument must be of very low resistance so that the current flow will not be retarded. It is important to remember that connections to the meter must be made so that the current enters at the plus terminal and leaves at the negative terminal. In Fig. 41 the ammeter is shown inserted in the circuit of Fig. 40.

A voltmeter is used to measure the potential difference between two points in the circuit carrying current. Since current is not measured in this procedure, the voltmeter leads are tapped across the points at which the pressure is to be indicated. A high resistance built into the voltmeter prevents it from being damaged by the current. The plus terminal of the instrument should be connected to the plus terminal of the unit in the line, such as a lamp, and the negative terminals of the voltmeter and lamp are

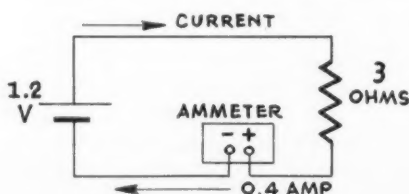


Fig. 41.

also connected. It is important to remember that an ammeter is inserted into the circuit and registers current flow (amperes). A voltmeter is connected across the circuit, where the difference in potential, or drop, is measured in volts. Fig. 42 represents a circuit with the voltmeter (V) and ammeter (A) included. The voltmeter indicates that the cell-voltage, 1.2 volts, is required to send a current of 0.4 ampere through the 3 ohms resistance unit.

Ohm's Law may be used to determine the voltage that must be applied to force a given current through a

$$\text{resistance in a circuit. } I = \frac{E}{R}$$

rewritten $E = IR$; that is, the voltage required for a circuit is equal to the product of the current (I) times the resistance (R). Referring to example 3, a current of 0.4 ampere flowing through a resistance of 3 ohms will require 1.2 volts. Proof: $E = IR = 0.4 \times 3 = 1.2 \text{ volts}$.

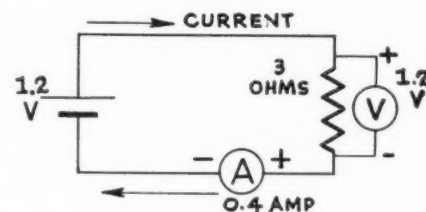


Fig. 42.

The potential drop (IR) for a current of 500 amperes flowing through bus bars with a resistance of 0.003 ohm will be $E = IR = 500 \times 0.003 = 1.5 \text{ volts}$.

In the same manner Ohm's Law may be applied in determining resistance.

$$I = \frac{E}{R} \text{ or } R = \frac{E}{I}$$

For example, if a current of 300 amperes flowing through a unit results in a potential drop of 0.15 volt, its resistance is

$$R = \frac{E}{I} = \frac{0.15}{300} = 0.0005 \text{ ohm.}$$

Series Circuits

When several pieces of electrical apparatus are connected end to end so that the current will pass around the circuit in a single path or a continuous path, the units are said to be arranged in series. In Fig. 43 three units represented by resistances $r_2 = 1.5 \text{ ohms}$; $r_3 = 4 \text{ ohms}$ and $r_4 = 6 \text{ ohms}$ are shown connected in series with three

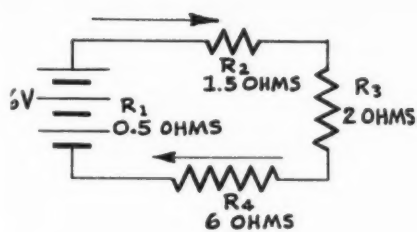


Fig. 43.

cells having a resistance of 0.5 ohm.

Ammeters introduced at several points in the circuit will show that the value of current flow at any point is the same. Since the resistance of the circuit regulates the amount of current flowing, it is evident that the total resistance is the sum of all the resistances, or $R = r_1 + r_2 + r_3 + r_4$. Substituting, $R = 0.5 + 1.5 + 4 + 6 = 12$ ohms. If the cell voltage is taken as 6 volts (2 volts for each cell), the current (I) may be determined by

$$\text{Ohm's Law, } I = \frac{E}{R} = \frac{6}{12} = 0.5$$

ampere. An ammeter inserted at any point in the circuit will therefore show a current flow of 0.5 ampere.

The voltage drop across each unit will vary with the resistance for that unit. A voltmeter tapped across each of the three resistances will indicate the voltage required to send the current of 0.5 ampere through the different resistances. These voltage drops are indicated in Fig. 44.

$$\begin{aligned} r_2, E &= IR = 0.5 \times 1.5 = 0.75 \text{ volt} \\ r_3, E &= IR = 0.5 \times 4 = 2.0 \text{ volts} \\ r_4, E &= IR = 0.5 \times 6 = 3.0 \text{ volts} \end{aligned}$$

$$5.75 \text{ volts}$$

$$\text{Cell voltage drop } r_1, E = IR = 0.5 \times 0.5 = 0.25 \text{ volt.}$$

$$\text{Terminal cell voltage} = 6 - 0.25 = 5.75 \text{ volts.}$$

The voltmeter cross r_2 indicates that 0.75 volt of the 5.75 terminal cell voltage is necessary to send a current flow of 0.5 ampere through that unit; across r_3 2.0 volts are necessary, and across r_4 3.0 volts are required for a

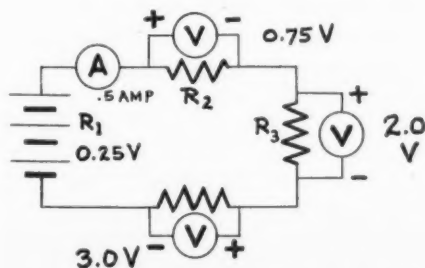


Fig. 44.

current flow of 0.5 ampere. The total, $0.75 + 2.0 + 3.0 = 5.75$ volts, checks with the terminal cell voltage of 5.75 volts. In a series circuit therefore, the total voltage across different units or parts is equal to the total voltage applied to the entire circuit. In a series circuit the following rules apply:

The current in any part of a series circuit is the same.

The total resistance is the sum of all the resistances.

The total voltage across different parts is equal to the voltage applied to the entire circuit.

Parallel Circuits

In a parallel (divided) circuit the current may flow through two or more different channels or routes. If two wires, one containing a resistance of two ohms and the other a resistance of eight ohms, are connected in parallel to a 12 volt cell, the current flow will be greater through the line with the lower resistance. The total current, however, will be equal to the sum of

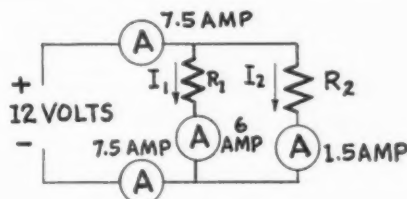


Fig. 45.

the current flow in each circuit (Fig. 45). By Ohm's Law, the wire with the 2 ohm resistance, r_1 , will carry a current of $I_1 = \frac{E}{R} = \frac{12}{2} = 6$ amperes

$$\text{and the 8 ohms resistance line, } r_2, \text{ will}$$

$$\text{carry a current of } I_2 = \frac{12}{8} = 1.5$$

amperes. The total current is therefore equal to $I = I_1 + I_2 = 6 + 1.5 = 7.5$ amperes.

The voltage across each branch of the parallel combination will be

$$E_1 = I_1 R_1 = 6 \times 2 = 12 \text{ volts.}$$

$$E_2 = I_2 R_2 = 1.5 \times 8 = 12 \text{ volts.}$$

It is apparent that the voltage across each branch of the parallel combination is the same as that applied to the entire circuit.

The resistance for a parallel combination can be determined conveniently by the application of Ohm's Law. In the example indicated in Fig. 45, the total current flowing through the resistances r_1 and r_2 is $6 + 1.5 = 7.5$

amperes and the voltage across the combination is 12 volts.

$$\begin{aligned} I &= \frac{E}{R} \text{; or resistance (combination)} \\ E & \text{ (across both branches)} \\ &= \frac{12}{I \text{ (total current)}} \\ R &= \frac{12}{7.5} = 1.6 \text{ ohms} \end{aligned}$$

It will be observed that the resistance of the combined units, (2 ohms and 8 ohms) in the parallel circuit is only 1.6 ohms, which is less than that of the smaller resistance. This is due to the fact that more paths are available through which the current may flow. The formula for the combined resistance for a parallel circuit is derived in the following manner. For the two branches in Fig. 11:

$$I_1 = \frac{E}{R_1}; I_2 = \frac{E}{R_2} \quad I = I_1 + I_2$$

$$\text{Since } I = \frac{E}{R}, \text{ by substituting } \frac{E}{R} \text{ for } I$$

in each equation

$$\frac{E}{R \text{ (total)}} = \frac{E}{R_1} + \frac{E}{R_2}$$

E may be cancelled from each term,

$$\text{hence: } \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\text{Since } R_1 = 2 \text{ and } R_2 = 8,$$

By substitution:

$$\begin{aligned} \frac{1}{R} &= \frac{1}{2} + \frac{1}{8} = \frac{4}{8} + \frac{1}{8} = \frac{5}{8} \\ \frac{1}{R} &= \frac{5}{8} \text{ or } R = \frac{8}{5} = 1.6 \text{ ohms} \end{aligned}$$

The resistance for a parallel combination may be determined, as was shown above, by two methods. The voltage across the combination divided by the total current (sum of the current for individual branches) flowing through the circuit, is one method. In the second method, the formula

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \text{ etc. is used.}$$

In a parallel circuit the following rules apply:

The total current is equal to the sum of the current through each part $I = I_1 + I_2 \dots$. The voltage across

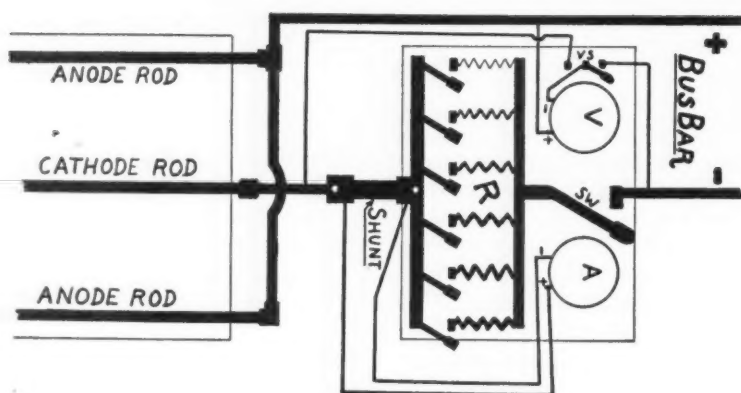


Fig. 46.

the resistances in a parallel circuit is the same.

The resistance (of combination) is obtained by dividing the voltage by the total current flowing through the combination.

Tank Rheostat

A tank rheostat is a unit introduced in a plating bath circuit for the purpose of regulating the current flow. This is accomplished by controlling the impressed voltage across the bath. It is in effect, a voltage drop device. Operation of a rheostat entails an application of Ohm's law. As an example, a bath having a fixed distance between anode and cathode requires 10 amperes plating current for a piece of work. If the resistance of the solution is 0.3 ohm, then the voltage drop for the solution is $E = IR = 10 \times 0.3 = 3$ volts. If the line voltage is six volts, then a 3 volt drop is necessary to obtain proper current in the bath. To do this, a resistor (rheostat) is inserted in series with the tank, so that the combined resistances of the solution, r_1 (0.3 ohm), and the resistance of the rheostat, r_2 , will result in a total voltage drop of 6 volts. Applying Ohm's law $E = I(r_1 + r_2)$ or $6 = 10(0.3 + r_2)$

$$\text{or } 6 = 3 + 10r_2; r_2 + \frac{3}{10} = 0.3 \text{ ohm.}$$

Suppose a new piece placed in the bath requires 5 amperes for a good plate and changes the effective bath resistance to 0.6 ohm. If the outside resistance r_2 (rheostat) remains at 0.3 ohm and the bath resistance r_1 is now

0.6 ohm, the plating current will be $E = I(r_1 + r_2)$ or $6 = I(0.6 + 0.3)$; $I = \frac{6}{0.9} = 6.67$ amperes. This

higher current will of course burn the work. The reason for the higher current is understood by the application of Ohm's law. Since $E = IR$, $E = 6.67 \times 6 = 4$ volts. If, as was shown, only three volts are necessary for a good plate, the higher voltage (4 volts) impressed on the bath accounts for the greater current flow.

Proper use of a rheostat is essential for current regulation. Consider a typical 150 ampere 3 volt drop rheostat of the parallel resistor type. Such a unit has five steps (switches) rated at 5, 10, 20, 40 and 80 amperes at 3 volt drop. The resistance for each switch (step) would be:

$$\text{Step 1 } R = \frac{E}{I} = \frac{3}{5} = 0.6 \text{ ohm}$$

$$\text{Step 2 } R = \frac{E}{I} = \frac{3}{10} = 0.3 \text{ ohm}$$

$$\text{Step 3 } R = \frac{E}{I} = \frac{3}{20} = 0.15 \text{ ohm}$$

$$\text{Step 4 } R = \frac{E}{I} = \frac{3}{40} = 0.075 \text{ ohm}$$

$$\text{Step 5 } R = \frac{E}{I} = \frac{3}{80} = 0.0375 \text{ ohm}$$

Suppose switch 1 (0.6 ohm) is thrown in for an object requiring 15

amperes. If a bath resistance of 0.2 ohm is assumed, then for $E = IR$;
 $6 = I(0.6 + 0.2)$ $I = \frac{6}{0.8}$

peres. Since step 1 is designed to carry only 5 amperes this is a 50% overload, whereas current flow, 7.5 amperes, is only half the amount required. By closing switch 1 (5 amperes) and switch 2 (10 amperes), the equivalent resistance of the switches in parallel is

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} = \frac{1}{0.6} + \frac{1}{0.3} = \frac{2}{0.6} + \frac{3}{0.6} = \frac{5}{0.6}$$

$$R = \frac{0.6}{5} = 0.12 \text{ ohm. By substitution, } E = I(r_1 \text{ rheostat} + r_2 \text{ bath})$$

or $6 = I(0.2 + 0.12)$ or $6 = 0.32I$; $I = 15$ amperes, which conforms with the 5 amperes allowed for switch 1 and 10 amperes for switch 2.

Plating Tank Wiring

A typical wiring diagram for a plating tank including rheostat, meters and switches is indicated in Fig. 46. The tank circuit is controlled by the master switch labelled sw in the diagram. The use of this switch for breaking the circuit obviates opening all the switches on the rheostat (labelled R) when unloading the tank.

The single pole double throw switch, vs , is used so that one voltmeter can be utilized for both bus bar voltage when the switch is in the up position, and tank voltage when the switch is down.

The ammeter is supplied with a pair of calibrated leads which should be used with the accompanying shunt. The shunt acts as a by-pass for the current (a parallel circuit) so that only a small portion of the current will flow through the meter, thereby protecting the instrument from damage. Without a shunt large conductors in the coil winding would be necessary.

SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
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METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Sulfuric Acid Anodizing Baths

Question: In the METAL FINISHING GUIDEBOOK the formula for mixing the anodizing solution for the sulfuric acid process is given and no specific gravity is given for the acid to be used. Would you please furnish me with the mixing data by volume when you use 66° Bé acid and any other specific gravities.

I would also appreciate very much receiving the instructions for a simple procedure to check strength of operating solution to detect when it should be replenished or dumped.

J. A. M.

Answer: The sulfuric acid strength used for calculating formulas in the METAL FINISHING GUIDEBOOK is 66° Baumé, since this is the acid most commonly employed. Amounts required for different percentage concentrations will be found in the section on anodizing, on page 431 of the 1955 edition. This volume also contains the analytical procedure on pages 497-8.

Since 60° acid contains 77.7% by weight sulfuric acid and 66° acid is 93.2% by weight, proportionally greater amounts of the weaker acid should be employed in making up an anodizing solution.

Non-Destructive Adhesion Test

Question: We are engaged in the overhaul of aircraft engines and are interested in any technical data you may have available for checking plating bond. Our main concern is in checking silver plating bond on aircraft engine parts, which have been in engine operation, without damaging the plated surface.

M. H.

Answer: We know of no method for testing adhesion of such deposits without destruction or damage of the surface. Most specifications call for a shear or chisel test.

A test which involves application of a vibrating hammer, such as a Burgess "Vibra-Tool," has been suggested recently. Using a rounded tool, blisters appear if the adhesion of the deposit is unsatisfactory. Although small peen marks will be produced on the surface, this type of test would be considered by far the least damaging.

Water Purification and Cadmium Recovery

Question: This letter conveys two questions which I would like answered at your earliest convenience.

1) Would you outline a method by which I can easily remove a high percentage of chloride in the water supply for my plating shop. Cl_2 as per recent analysis is 163.3 p.p.m. CaCO_3 .

2) I cadmium plate one hundred gross locks per day and they are all scratch brushed, due to the fact that the human factor creates a problem in the bright dipping process. They also cause a lot of dragout and the control of this is also a problem, since this means a lot of cadmium lost through dragout and scratch brushing. What is the best method one can use in recovering this metal by precipitation in the factory.

O. S. S.

Answer: The only practical method for removing chloride and other salts is the ion-exchange method.

Cadmium can be precipitated by passing the rinse water through mossy or sponge zinc. It can also be precipitated as the sulfide by addition of

sodium sulfide. However, recovery of pure cadmium for reuse would be uneconomical and the sludge should be sent to a refiner. If an ion-exchanger is employed, the cadmium can be recovered in usable form, while, at the same time, the rinse water can be re-used.

Tungsten Alloy Plating

Question: We are interested in tungsten electroplating. We know that it is difficult to obtain heavy deposits of tungsten but we would appreciate it if you could give us a bath formula.

Also, we have seen in "Protective Coatings for Metals" by Burns and Bradley that alloy of tungsten with nickel and tantalum may be electrodeposited. Any information you could give us would be appreciated.

Finally, have any successful or partly successful methods been worked out for the electrodeposition of molybdenum?

C. G. A.

Answer: There is no method, at present, for depositing pure tungsten from aqueous baths. It is deposited only as an alloy with other metals, such as nickel, iron, cobalt, etc.

The only bath for nickel-tantalum-tungsten alloy in our file is the bifluoride bath patented by Armstrong & Menefee (U.S. Pat. 2,160,322 May 30, 1939). A typical formula contains:

Tantalum pentoxide	35 g.
Ammonium bifluoride	85 "
Tungstic acid	40 "
Warm Water	1 L.

This is filtered and the following added:

Tartaric acid	60 g.
Citric acid	30 "
Nickel chloride	15 "
Sodium fluoride	60 "

Operate at pH 5.3, 3.5 volts, 2 amp./sq. in., 160 deg. F., using tungsten carbide anodes.

Baths have been developed experimentally for depositing molybdenum from aqueous solutions but they all suffer from the disadvantage of very low efficiency, only a few percent at best.

Prevention of Rust and Stains

Question: I am using a Virgo salt cleaner with a temperature of 900 deg. F. for descaling cast iron. After $\frac{1}{4}$ - $\frac{1}{2}$ hour, I rinse and quench the parts in cold water to loosen the scale, then immerse in 20% muriatic acid at 100 deg. F. Finally, I rinse in hot water from which the parts come out rusty and also the water gets rusty.

How can I correct this? Is there anything I can put into the hot water so that the steel or iron will dry quickly and leave no stains and rust spots?

A. C.

Answer: At least one, and preferably two cold rinses should precede the hot rinse to avoid carry-over of acid into the hot water. Various rust preventives are available and the use of a small amount of soap or wetting agent in the hot water will result in faster, stain-free drying.

Small Scale Plating

Question: I would like to know if it is possible to take an automobile generator and rig it to be used for electroplating on a laboratory scale.

In making up an acid copper sulfate bath of 25-35 oz./gal. of CuSO_4 and 6-11 oz./gal. of H_2SO_4 , is the H_2SO_4 liquid oz. or oz. by weight?

C. W. D.

Answer: An auto generator will be quite suitable for small scale electroplating use. If you use one of the old type third brush generators, you will be able to adjust your current without using a heavy rheostat by adjusting the position of the third brush.

In the acid copper solution, the amount of sulfuric acid is given in avoirdupois ounces, not fluid ounces. Use $3\frac{1}{2}$ -4 fluid oz. of concentrated acid per gallon.

Plating Over Silver and Nickel

Question: We would request data on plating .005" or more thickness silver or nickel on surfaces that have been previously plated and machined or possibly work hardened by service. Will redeposition cause a lamination at the interface?

P. J. F.

Answer: With proper preparation, there should be no lamination between silver deposits. Alkaline cleaning, followed by scratch-brushing with pumice and water and a cyanide dip is sufficient. The parts are then silver struck and plated, as usual.

It is more difficult to produce adher-

ent deposits of nickel on nickel. The common procedure is to strike in a solution containing 2 lbs. nickel chloride and 1 pint muriatic acid per gallon. This solution is used at 6 volts, room temperature, 1-2 minutes, with carbon or nickel anodes.

Barrel Brass Plating

Question: We would appreciate any information you could furnish us on the optimum conditions and solution composition for barrel brass plating.

R. K.

Answer: Data on solution composition, brightener additions and operating conditions will be found in the METAL FINISHING GUIDEBOOK. The formula for a barrel bath is the same as for still plating. However, 9-10 volts should be used for the former.

It is suggested that the solution be made up with about $6\frac{1}{2}$ oz./gal. of sodium cyanide, since the cathode efficiency of a new bath is quite low and the full amount of cyanide may result in copious gassing with very little deposit. As the solution ages, the free cyanide content is slowly increased.

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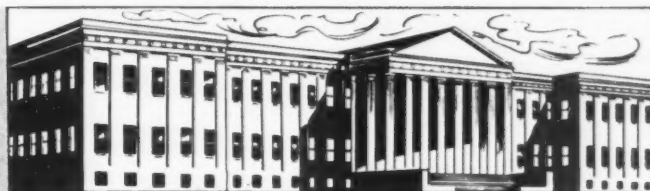
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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Thickness Measurement

*U. S. Patent 2,723,351. Nov. 8, 1955.
J. W. Garrison and R. F. Humphreys,
assignors to the United States of
America.*

In the method for determining the thickness of prescribed metal coatings wherein said metals are activated to beta particle emitting isotopes when subjected to the radiation of thermal neutrons, the steps comprising subjecting said metal coatings to the radiation of said thermal neutrons for a predetermined period thereby activating said metals to isotopic forms, discontinuing said neutron radiation to permit said metal coating to become deactivated with an accompanying emission of beta particles, and recording the number of said beta particles emitted by said metal coatings for a predetermined period during said deactivation.

Dust Collector

*U. S. Patent 2,723,513. Nov. 15, 1955.
B. K. Slonneger.*

A dust collecting device for a polishing wheel or belt, comprising in combination, a main housing provided with a dust sump; a plurality of individually adjustable members slidably supported in the main housing, certain of said members being individually movable to form an enclosure for selected portions of the wheel or belt while other portions are exposed for use, certain other members being individually movable to form air conduits between the wheel or belt and the sump in the main housing; and a secondary, open sided housing removably attached to the main housing, said secondary housing carrying a filter in each open side thereof said filters being operative to permit the air generated by the wheel or belt and directed through said conduits to be discharged from the secondary housing through said filters while the dust in said air is retained within the main housing and collected in the sump.

Phosphate Conversion Coating

*U. S. Patent 2,724,668. Nov. 22, 1955.
W. S. Russell, assignor to Parker Rust
Proof Co.*

A composition of matter for forming by spraying, a phosphate coating on metallic surfaces which consists essentially of an aqueous alkali metal phosphate solution containing an oxidizing agent, and .01% to 2% of an alkali metal lignosulfonate, said solution having a pH of 4.2 to 6.0.

Gold Alloy Bath

*U. S. Patent 2,724,687. Nov. 22, 1955.
V. Spreter and J. Mermillod.*

A bath for the deposition of an alloy of gold with at least one metal selected from the group consisting of copper, nickel, cadmium and zinc, said bath containing exclusively an alkaline aurocyanide and at least one organometallic compound selected from the group consisting of the copper, nickel, cadmium and zinc salts of ethylenediamine-tetraacetic acid, nitrilo-triacetic acid, anthranilic-diacetic acid, uranyl-diacetic acid and aminomalonic-diacetic acid, whereby the yield, computed on the basis of the current consumed as compared to the weight of metal deposited, remains constant during the whole life of the bath.

Automatic Plating Control

*U. S. Patent 2,724,691. Nov. 22, 1955.
L. G. Hakes, assignor to Western
Electric Co.*

A plating apparatus, which comprises a container for an electrolytic plating bath, anode means extending along the bath, conveyor means for advancing a series of articles through the bath one after another along a path in such a manner that each article is in the bath for substantially the same period of time, a plurality of cathode rails extending along the bath in positions adjacent to said path through the bath, means for sequentially connecting said articles to different cathode rails, means for applying

such potentials across each cathode rail and the anode of the bath individually that a predetermined quantity of electricity flows through each article in a period of time slightly less than said predetermined period of time, means for measuring the quantity of electricity flowing through each cathode rail, and means responsive to the measuring means for cutting off the potential-applying means from each cathode rail individually when said predetermined quantity of electricity has passed through the article.

Belt Polisher

*U. S. Patent 2,722,788. Nov. 8, 1955.
O. Thiel, assignor to Midwest Supply
& Mfg. Co.*

Apparatus of the class described comprising means for supporting and driving a continuous abrasive belt, means for effecting continuous revolution of a work piece in an arcuate path impinging the belt, means for supporting the portion of the belt engaged by the work piece comprising a pair of rollers spaced from opposite ends of the zone of impingement, means mounting said pair of rollers for movement generally toward and away from the path of movement of the work piece, and camming means including a part movable with a work piece for moving said pair of rollers in accordance with movement of the work piece to control the pressure between the belt and work piece said camming means comprising a plate generally parallel to the line joining the axes of said pair of rollers, and a cam movable with the work piece in its arcuate travel.

Strip Plating Machine

*U. S. Patent 2,723,953. Nov. 15, 1955.
P. A. Burgemeister and H. J. Healy,
assignors to Crown Cork & Seal Co.,
Inc.*

In electrolytic plating apparatus, a plating tank, a plurality of plating anodes positioned in said tank, means

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for guiding a strip to be plated in juxtaposition to the anodes and for moving the strip at a predetermined constant rate of speed, a plurality of said plating anodes being positioned to plate on one side of the strip and arranged in at least one group and a second plurality of anodes including at least one group being positioned to plate on the opposite side of the strip, means for electrically connecting the anodes of the groups to a source of electric current, said connecting means comprising electrically controlled switch means for each of the anodes, control circuits including relays for actuating the switch means for predetermined groups of anodes and a

master switch means for energizing said relays.

Electrolytic Coating for Magnesium

U. S. Patent 2,723,952. H. A. Evangelides.

An electrolytic bath for forming a coating on the surface of articles of magnesium and magnesium base alloys consisting essentially of 1 to 60 gms. per liter of a manganate selected from the class consisting of sodium and potassium manganates, 1 to 300 gms. per liter of any anhydrous fluoride selected from the class consisting of sodium and potassium fluorides, 10 to 300 gms. per liter of a phosphate se-

lected from the class consisting of sodium and potassium phosphates, 20 to 130 gms. per liter of an alkali metal hydroxide from the class consisting of sodium and potassium hydroxides, and 1 to 125 gms per liter of an aluminum compound selected from the class consisting of aluminum hydroxide potassium aluminate and sodium aluminate.

Rust Preventive Compositions

U. S. Patent 2,724,654. Nov. 22, 1955. W. C. Howell, Jr. and W. E. Waddey, assigns to Esso Research and Engineering Co.

A rust preventive composition comprising about 75 to 98% by weight of volatile hydrocarbon solvent having a boiling point below about 500°F., about 1 to 15% by weight of a viscous propane precipitated resin from Pennsylvania oil residuum, and about 1 to 10% by weight of a mono-oleate ester of a polyhydric alcohol.

Pickling Titanium

U. S. Patent 2,724,667. Nov. 22, 1955. C. D. MacPherson, assignor to Wayne Foundry & Stamping Co.

In a process of removing scale from titanium, the step of immersing the metal in a hydrofluoric acid solution of approximately 60% concentration at room temperature.

Automatic Plating Control

U. S. Patent 2,724,690. Nov. 22, 1955. J. E. Solecki, assignor to Western Electric Co.

An apparatus for electroplating articles, which comprises an elongated plating tank for a plating solution, anode material extending along the tank, a plurality of carriers for supporting racks and connected electrically thereto, a plurality of racks for carrying articles to be plated, conveyor means for lowering the racks one at a time into the tank, advancing them along a predetermined path through the tank, lifting them from the tank, holding the lifted racks over the tank and moving the lifted racks beyond the tank, said conveyor means serving to keep each rack in the tank for substantially the same period of time, a plurality of cathode rails extending coextensively in parallel laterally spaced positions adjacent to said path through the tank, contactors mounted on some of said carriers for

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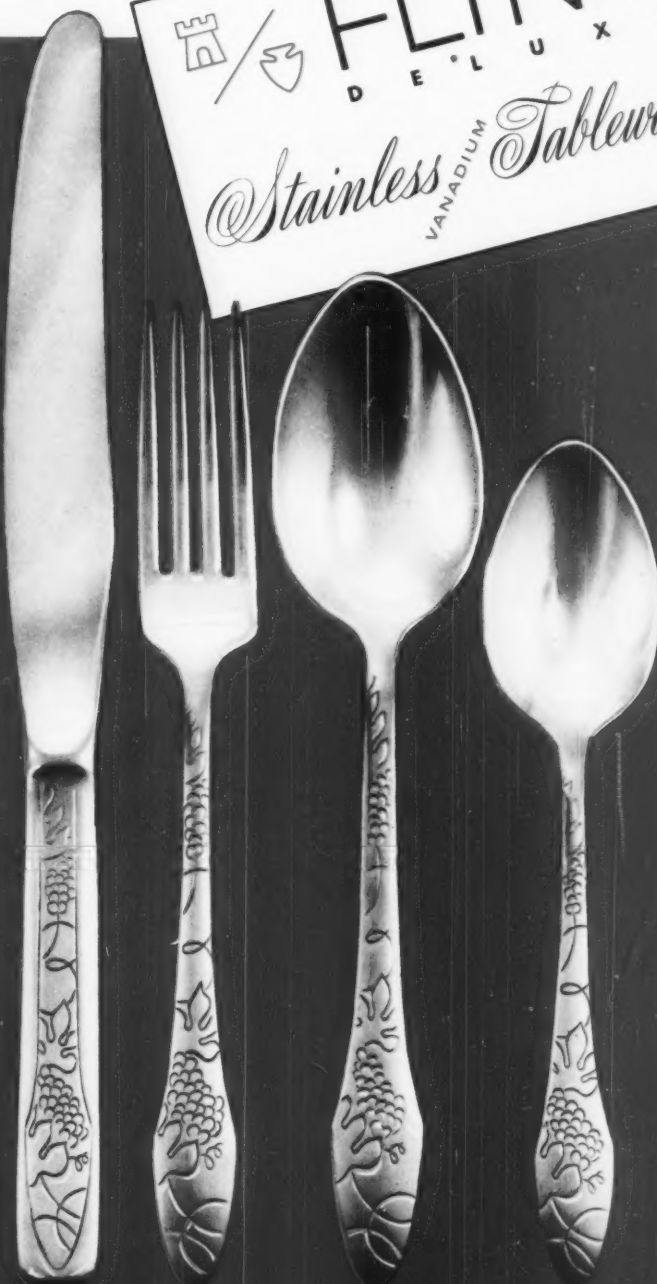
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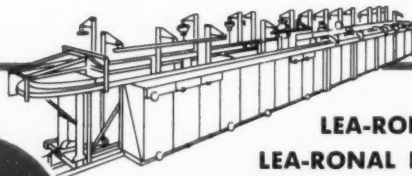
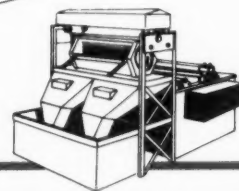
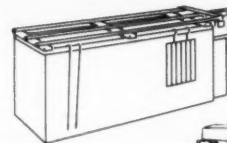
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engaging one of the cathode rails as each of the last-mentioned carriers is lowered by the conveyor means to place the rack carried by the carrier in the tank, contactors carried by others of the carriers for engaging a second one of the cathode rails, means for applying sequentially a strike potential and a plating potential individually to said cathode rails and the anode material, means individual to each of the cathode rails for metering the quantity of electricity forced through each of the cathode rails, means responsive to the metering means for actuating the potential-applying means to change from a strike potential to a plating potential, means responsive to the metering means for stopping the flow of electricity to the cathode rail associated therewith when a predetermined quantity of electricity has flowed through the carrier in engagement with that cathode rail, and means for preventing movement of a carrier beyond the cathode rail it is engaged with before the operation of the stopping means.

Tumble Abrasive Blasting

*U. S. Patent 2,724,929. Nov. 29, 1955.
R. W. Moore, assignor to Pangborn Corp.*

A continuous blasting mill comprising a tumbling barrel assembly mounted for rotation on the axis thereof, means to discharge a blasting stream of abrasive particles toward workpieces within said barrel assembly, means for feeding workpieces laterally into said barrel assembly including a conveyor provided adjacent one end of said barrel assembly, a workpiece delivery means and a rotatable baffle member adjacent said conveyor, said conveyor and said baffle member being in operative driving relationship with each other and being so constructed and arranged relative to each other that they coact to convey workpieces into one end of said barrel assembly, and a helicoidal baffle coaxially positioned within at least part of said barrel assembly and extending across the full cross-sectional internal area thereof for the purpose of obstructing and preventing egress of rapidly flying particles of abrasive and detritus therefrom.

Double Sand Blasting Nozzle

*U. S. Patent 2,724,928. Nov. 29, 1955.
W. S. Kirkland.*

A sand blasting nozzle comprising a

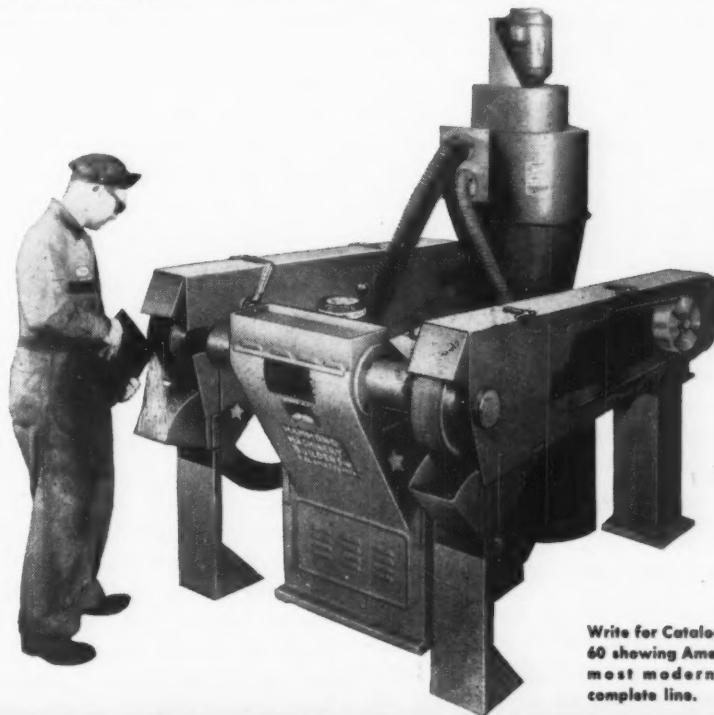
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pipe, a hollow U-shaped head connected to said pipe, nozzles connected to the ends of said U-shaped heads, a divider formed in said head and having its apex in alignment with said pipe, said divider forming a hollow chamber in said head, said head having a pair of dividing walls extending from said pipe toward the outer sides of said head and forming chambers therebetween.

Anodizing Aluminum

*U. S. Patent 2,721,835 Oct. 25, 1955.
W. G. Axtell, assignor to Shwayder Bros., Inc.*

A method of surface treating an aluminum article, which comprises immersing said article in an electrolytic solution consisting of about 0.3%

chromic acid, as CrO_3 , 1.68% phosphoric acid, and the balance water; maintaining said solution at a temperature between 60°F. and 120°F.; passing an electric current through said article as the anode at from 2 to 30 volts, for a period of between 5 seconds and 2 minutes; removing said article from said electrolyte; and, without washing or complete drying, dipping said article in a liquid selected from the group consisting of alkyd base enamels, oil varnish base enamels, and oil base paints.

Antimony Bath

*U. S. Patent 2,721,836. Oct. 25, 1955.
A. H. Du Rose, assignor to The Harshaw Chemical Co.*

An aqueous antimony plating solu-

tion comprising antimony trifluoride in concentration from 0.3 to 0.9 mol per liter, an aliphatic alpha hydroxy carboxylic acid in quantity from $\frac{1}{8}$ to 2 alpha hydroxy equivalent weights per atomic weight of antimony and an alkaline compound in quantity to produce a pH between 2.5 and 5.0.

Anodizing Zippers

*U. S. Patent 2,721,837. Oct. 25, 1955.
J. Backer, assignor to Aero Zipp Fasteners, Ltd.*

A method of anodizing a metal article, comprising the steps of containing an anodic bath in a vessel, introducing the article into the anodic bath, whirling the vessel around an extraneous axis and creating a centrifugal force acting on the metal article, and passing an electric current from an anodic contact element in the vessel through the article and thence through the anodic bath in contact with the article to a cathodic contact element in the vessel while holding the article against, and in electric contact with, said anodic contact element by centrifugal force.

Copper-Tin Alloy Bath

*U. S. Patent 2,722,508. Nov. 1, 1955.
E. Heymann and G. Schmerling.*

A liquid for use as the electrolyte in an electrolytic bath for the deposition of a copper-tin alloy selected from the group consisting of an alloy of copper and tin, an alloy of copper, tin and up to 2.5% aluminum, and an alloy of copper, tin and up to 3% of an aluminum and magnesium alloy from anodes of the alloy to be deposited, said liquid composed of water, having dissolved therein 5-25% copper cyanide, 10-50% sodium stannate, 10-35% sodium cyanide, 3-5% sodium hydroxide and 10-45% sodium citrate.

Plating Apparatus for Electrical Rectifiers

*U. S. Patent 2,721,839. Oct. 25, 1955.
H. L. Taylor, assignor to Westinghouse Air Brake Co.*

A fixture for holding plates in an electrolytic bath comprising a mask of resilient material, said mask being provided with a plurality of openings, an annular shoulder in each of said openings for seating a plate disposed in the mask opening, a base plate, a member clamping said mask to said base plate to form a fluid-tight seal between said mask and said base plate, resilient contact means on said base

plate for engaging the plates in said mask openings, said resilient contact means forcing the plates within the mask openings against their respective annular shoulders to form a fluid-tight seal therewith, said member having a plurality of openings coaxial with said mask openings, a port terminating in each of said member openings, means for connecting said port to a pump whereby the electrolytic fluid is moved through said ports and member openings over the exposed surfaces of the plates seated in the mask openings, electrodes received within said member openings with some clearance, and means for connecting said electrodes and said resilient contact means into an electrical circuit.

Vapor Degreaser

*U. S. Patent 2,722,593. Nov. 1, 1955.
T. F. McAlister, assignor to Ben W. Sager.*

Vapor degreasing apparatus comprising a tank in which an article to be cleaned is to be placed, an electric heater adapted, when energized, to vaporize a solvent and cause the same to fill said tank to a predetermined level, and means for controlling the vapor level comprising a thermostat mounted in the tank, said thermostat having contacts which when actuated shut off the heater when the vapor has risen to a selected predetermined level, and means for selectively adjusting the vapor level in the tank by varying the thermostat setting to vary the temperature at which said contacts will be actuated.

Buffing Head

*U. S. Patent 2,722,784. Nov. 8, 1955.
O. Thiel, assignor to Midwest Supply & Mfg. Co.*

In apparatus of the character described, a buffing head having a rotatably driven buffing element, a pivot extending from the head at right angles to the rotational axis of the buffing element, a carrier receiving and rotatably supporting said pivot, a pivot extending from the carrier at right angles to said first-mentioned pivot and at right angles to the rotational axis of the buffing element, a support receiving and rotatably supporting said last-mentioned pivot, and means for damping oscillatory movement of each pivot in both directions about the pivot axis, each of said damping means comprising a cylinder-and-piston assembly disposed at right

angles to its respective pivot, the cylinder being fixed relative to its pivot and having liquid-filled chambers at opposite ends of the piston and the latter being reciprocable in the cylinder and provided with a restricted passage extending longitudinally entirely therethrough, pinions on the ends of the pivots and racks on the pistons engaged by the pinions and operative to translate oscillatory movement of the pivots into reciprocatory movement of the pistons.

Impact Plating

*U. S. Patent 2,723,204. Nov. 8, 1955.
R. Pottberg and E. T. Clayton, assignors to Peen Plate, Inc.*

Ten pounds of ten mesh cracked shot (grit), already well coated with zinc were charged to a small mill seven inches in diameter by eight inches long, together with three-fourths pounds of clean, dry zinc dust, the particle size of which varied between three and fifty microns. Three pounds of six penny nails, previously treated in a dilute mineral acid solution and thereafter dried, were then added and the mill closed. The mill was rotating at fifty-seven revolutions per minute for three hours at room temperature. The zinc coating which resulted was continuous and uniform, and averaged .001 inch in thickness.

Belt Polisher

*U. S. Patent 2,722,786. Nov. 8, 1955.
G. A. Carlson.*

Apparatus of the class described comprising a vertical column, a first support member movable vertically on and angularly adjustable about said column, a second support member carried on said first support member for angular adjustment about a vertical axis spaced laterally from the axis of said column, a third support member mounted on said second member for angular adjustment about a horizontal axis, a fourth support member mounted on said third support member for angular adjustment about an axis perpendicular to said horizontal axis, a bracket rigidly mounted on said third support, an elongated arm on said bracket, a drive pulley carried by said arm, a pair of guide pulleys carried by said arm, a contact wheel intermediate said guide pulleys mounted for movement generally perpendicular to a plane joining the axes of said guide pulleys, a tension adjusting pulley carried by said arm, and

an operating belt trained over said pulleys and contact wheel.

Pattern Polishing

*U. S. Patent 2,723,505. Nov. 15, 1955.
F. G. Kraft, assignor to The Thompson Grinder Co.*

In a machine for finishing a work member to provide the same with a predetermined fixed pattern abraded into the surface; a rigid roll, idler rollers adjacent said roll, a flexible abrasive belt passing about said roll and rollers, and said roll comprising uniformly axially and circumferentially spaced radially projecting integral portions of uniform configuration, and which are hard and substantially unyielding, grooved spaces between said projections, said spaces being filled with a resilient material so that said roll is normally cylindrical but will be deformed at least slightly upon the application of pressure thereto when it is brought into engagement with a work member.

Pickling Copper Alloys

*U. S. Patent 2,723,925. Nov. 15, 1955.
E. N. Ludington, assignor to Bridgeport Brass Co.*

A process for removing vitreous lubricant from metal which has been hot-worked under pressure against the lubricant, the process including quenching the metal from an elevated temperature and thereafter pickling the metal in a pickling solution in which the lubricant is substantially insoluble prior to the hot-working, said metal being cuprous and said solution being of the class consisting of water solutions of sulphuric acid, and of sulphuric acid and sodium dichromate.

Abrasive Blasting Machine

*U. S. Patent 2,723,498. Nov. 15, 1955.
H. Hastrup and D. F. Pinkerton.*

A portable abrasive blasting machine comprising a nozzle unit including a blast nozzle, means for supplying compressed air to said nozzle, an abrasive container having a normal vertical position, means for supplying abrasive to said nozzle from said container, an air-abrasive separator connected to the output of said nozzle unit, and pivotal conduit connection means between said container and said separator, whereby said container may be maintained in vertical position irrespective of the position of said nozzle.



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ABSTRACTS

Coloring of Brass

Metallwarenindustrie und Galvanotechnik, Vol. 45, No. 8, pp. 402.

Troubles arising from the coloring of polished brass parts are discussed; the color as applied was satisfactory but, after lacquering, the transparent lacquer was found to flake the color off the metal. The trouble is ascribed to the fact that polished brass sheet is being handled. No good adhesion of the color can be attained on this material. It is recommended that, to minimize this trouble, care must be taken to give a very good cleaning be-

fore coloring. Oxide coatings which may have been formed on the metal, and which may affect the adhesion, should be removed before by a dilute cyanide solution.

Black Color on Tin-Copper Alloy Plate

Metallwarenindustrie und Galvanotechnik, Vol. 45, No. 8, p. 403.

Tin-copper alloys of the speculum type can be colored black as follows:

1. The plated parts are well rinsed, care being taken that all residual solution is removed from the pores.
2. The parts are then dipped for 2-3 minutes in cold, concentrated nitric acid.
3. This is followed by a rinse in cold water.

4. The parts are dipped for 5 minutes in a boiling 3% solution of yellow ammonium sulfide.

5. The coloring dip is followed by a rinse in flowing water.

6. The parts are dried.

7. A scratch brushing is then given with a steel wire brush.

Continuous Closed-Circuit Pickling with Bath Regeneration

F. J. Heinrich: *Beiztechnik*, 4, No. 3, pp. 36-39.

German developments are considered using the hot processing of pickling bath waste liquors (sulfuric acid pickling) in conjunction with the processing of the iron sulfate monohydrate which is formed using steam and nitric acid. This is converted into sulfuric acid and iron oxide. Although at present this process is still at the laboratory stage, in technical practice there are no overwhelming difficulties in the way which cannot be overcome.

With this process, which is more significant in the case of large scale pickling, such as continuous pickling lines for hot and cold rolled steel strip and sheet, apart from the normal low processing losses, all the materials passed into the pickling process can be recovered and accordingly this would make possible for the first time, continuous sulfuric acid pickling in a closed-circuit procedure, in which the materials circulate continuously.

The first stage of the procedure, the precipitation of ferrous sulfate monohydrate is based on the solubility of ferrous sulfate in sulfuric acid solutions falling off strongly with rising sulfuric acid content. In 50% sulfuric acid, there are only a few per cent of iron sulfate soluble. Accordingly if this procedure is to be utilized for the processing and regeneration of sulfuric acid pickling bath wastes then the pickle must be enriched, either by the addition of fresh sulfuric acid or else by reduction of the water content. The only commercial method is to evaporate the water.

Investigation of the Cathode Polarization with Mutual Discharge of Iron and Tungsten Ions

S. A. Solowjewa and A. T. Wagramjan: *Izvestija Akademii Nauk U.S.S.R.* (Journal of U.S.S.R. Scientific Academy—Chemical Section—Russia), No. 2, pp. 230-235 (1954).

The authors measured the electrode

potential with the mutual discharge of iron and tungsten ions and established that their mutual separation potential is located lower than the normal potential of tungsten. The energy difference which occurs is covered, in all probability, by the formation of chemical compounds of the type Fe_3W . Accordingly, the deposition of iron and tungsten does not follow as separate coatings, but as an alloying procedure, so that periodic potential fluctuations as is required by Holt [(Trans. Electrochemical Soc., 94, No. 2 (1948)] for his theory of "catalytic reduction" does not occur.

A New Method for Researching the Mechanism of the Cathode Processes and its Application

M. Smjalowski and S. Schkljarskaja-Smjalowskaja; *Izvestija Akademii Nauk U.S.S.R.* (Journal of the U.S.S.R. Scientific Academy—Chemical Section—Russia), No. 2, pp. 225-229 (1954).

A cathode in the shape of a cylindrical spiral of thin iron wire undergoes deformation as a result of the absorption of atomic hydrogen, during the electrolysis of aqueous acid solutions. This phenomenon was used by the authors for the investigation of the course of the electrolysis and of the cathode processes.

In this way, among other things, they established that some elements of the 5th and 6th main group of the periodic system (phosphorus, sulfur, arsenic, antimony, selenium, tellurium) cause a strong checking of the recombination of atomic hydrogen to H_2 molecules and, through this, influence the hydrogen pressure at the cathode surface. It is suspected that this characteristic stands in relationship with the stability of the hydrogen compounds of the elements concerned.

Testing of Stainless Steel for Inter-Crystalline Corrosion

M. A. Streicher; *Werkstoffe und Korrosion*. Vol. 5, No. 10, pp. 363-368.

The author discusses the testing of stainless steel for inter-crystalline corrosion by means of electrolytic etching in oxalic acid. In the U.S.A. the sensitivity of stainless steel to inter-crystalline corrosion is generally examined by determination of the corrosion velocity in boiling 65% nitric acid for a reaction time of 240 hours. A pro-

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cess for testing is described, which permits certain stainless steels to be tested for their tendency to inter-granular corrosion in about 15 minutes on the basis of the fine structure which is developed by electrolytic etching in oxalic acid.

Steels which show, with this treatment, only a slight or in the main, no attack as a result of carbide precipitations at the grain boundaries are not liable to rapid inter-crystalline corrosion and therefore do not need to be subjected to the nitric acid test. Steels on the other hand, which show a noticeable inter-granular attack with the oxalic acid etching test, must subsequently be tested in nitric acid in order to establish whether the de-

gree of the inter-granular sensitivity exceeds the limit which is given by the maximum corrosion speed in nitric acid for the applicability of the steel.

Pickling Inhibitors in Theory and Practice

A. Pollack; *Metaloberflaeche*. Vol. 9, No. 2, pp. 17A to 22A (1955).

Pickling economies have been achieved mainly by the following measures: (1) Material savings by the employment of pickling inhibitors; (2) Acceleration of the pickling process and consequently increased production by the use of pickling activators; (3) Material saving by the utilization of the pickling acids with the least possible residue by pickling at

higher temperatures; (4) Recovery of acid and iron sulfate; (5) Improvement in the construction of the pickling layouts and by modern pickling processes.

The author then gives the various theories and explanations on the action of the pickling additions and is of the opinion that not all the explanations proffered are complete and unequivocal for all special cases. The development of pickling inhibitors has reached a peak but, nevertheless, research on this subject is still proceeding. The most important requirements for a good pickling inhibitor apart from the restrictive action are as follows:

(1) Good solubility in the pickling acids; (2) Hindrance of a localized attack on the steel surface; (3) Temperature stability and chemical resistance characteristics against other materials, for example, the pickling acids, the reducing action of the hydrogen evolved during the pickling process and atmospheric oxygen and, finally, chemical stability in itself, i.e. no tendency to decomposition, resinification, hydrolysis, etc.; (4) The least possible poisonous characteristics and no strong or objectionable smell to be evolved in use.

Among the most effective pickling inhibitors which are in use at the moment belong hexamethylenetetramine, the thiourea compounds and dibenzylsulfoxide. The inhibitor mixtures which are marketed commercially, contain, in addition to these compounds, salts, acids, wetting agents, solvent adjusters, extending agents, etc. A whole series of other compounds have been proposed as pickling inhibitors.

Surface reactive compounds such as alkylaryl sulfonates or sulfonated ethylene oxide condensation products have been recommended as pickling accelerators. These wetting agents facilitate penetration through the rust and scale, this penetration being somewhat reduced by the inhibitors. The running-off of the acid is also facilitated and, consequently, there is less drag-out of acid from the pickling bath. By an increase in temperature from 50° to 80°C. the speed of the pickling reaction is increased and, through this, better use is made of the plant, with sulfuric acid pickling. Great technical interest attaches in recent times to recovery of the bath residues.

In the course of years, the mechanical equipment, particularly in connection with continuous large scale pickling, has been constantly improved. Spray pickling must be regarded as a relatively new process.

The Paroxal 2 Process for Degreasing and Pickling of Aluminum

G. Riviere: *Revue de L'Aluminium*. Vol. 30, No. 208, pp. 101-102.

Solutions based on phosphoric acid for the treatment of the surfaces of aluminum and the aluminum alloys have received attention because, among other things, they favor the formation of a very thin phosphated surface skin. Although the object of the surface treatment may not be to directly dissolve metal from the surface of the component, it can nevertheless not be completely avoided during the processing. It resolves itself accordingly into removing the smallest amount of metal possible during the treatment.

The degreasing agent and pickling medium "Paroxal 2" which is described is a complex product on a phosphoric acid basis. It possesses the characteristic of simultaneously strongly degreasing and slightly pickling.

Control Measures with Phosphating Baths

Beiztechnik. Vol. 4, No. 5, pp. 68-69.

The control measures necessary to ensure good results with the phosphating process fall into three classifications (1) the ware to be treated; (2) the phosphating solutions and (3) the finished coating.

The parts to be treated should be free from grease and oil and coarse pieces of rust-scale. It is particularly necessary to ensure that, with a prior conducted pickling in sulfuric or hydrochloric acids, the last traces of these two acids are removed from the surface, since sub-surface corrosion may be caused and also bath disturbances during phosphating. Similarly, with a prior degreasing in aqueous alkaline solutions, care should be taken that no portion of the alkali passes into the phosphating solution. The handling and hanging arrangements such as wires, hooks, etc., as well as the baskets should be constructed of the same material as the ware being treated. It can be of ad-

vantage to construct the baskets of ceramic or plastic material. Special care must be taken that different metals are not simultaneously handled in the same bath.

With the phosphating baths themselves care must be taken that cleanliness is observed and sludge formed during the treatment must be removed from time to time. With continuous operation, composition control should be conducted daily for the pH value, the content of effective phosphating solutions, the point number, and dissolved iron. The point number consists of a determination of the total phosphoric acid by titration with 1/10 N NaOH and phenolphthalein indicator. If methyl orange is used as indicator, only the free phosphoric acid is titrated. The analysis of the iron is conducted by titration with 1/10 KMnO₄.

To control the finished phosphate coating for corrosion protection, a certain portion of the treated ware (about 1%) is immersed for a period of about 15 minutes in a 3% solution of sodium chloride. The parts are then rinsed in clear, cold tap water and dried at room temperature. With a sufficient rust-protective effect the ware so treated, even at 6 times magnification examination, should show no brown discoloration and no rust spots.

Recovery Treatment of Waste Liquors from Unusable Nickel Plating Baths

M. Straschill: *Beiztechnik*. Vol. 4, No. 6, pp. 81-83.

As nickel salts are relatively expensive, when an old bath is being recovered, endeavors should be made to recover at least a part of the waste nickel. In most baths the nickel will occur as sulfate or chloride with a certain amount of boric acid as well as small additions such as brighteners or certain metal salts. Any salt recovered must be prepared as pure as possible. The recovery treatment to be given will depend upon the bath analysis. Organic impurities such as the decomposition products of brighteners, wetting agents, oil residues, etc., can be destroyed by boiling with potassium permanganate. These can be more easily removed by treatment with activated carbon. About 1 kg. of

carbon will serve to treat 100 liters of solution. The carbon need merely be thrown into the solution, stirred well and then the liquor filtered.

The metals which are nobler than nickel, such as copper, lead, silver, or mercury, can be removed by "cementing out" on pure nickel sheets hanging in the solution or by stirring in nickel powder or granules. Further impurities, such as iron and other metals can be removed by the addition of a slurry of freshly precipitated nickel hydroxide or carbonate and raising of the pH to about 6.5. With correct adjustment of the precipitating agent, there is little nickel in the precipitate. Other impurities such as zinc, arsenic, etc., as well as organic compounds, can be removed by precipitation with ferric sulfate (about 20-25 g. per 100 liters) and heating to 70°C. with subsequent oxidation by hydrogen peroxide (100 g. of 30% solution). Electrolytic purification can be employed, comprising the separation of the metallic impurities on iron auxiliary cathodes with a low current density. Ion exchangers can also be employed.

Pitting in Nickel Plating Baths

P. Clamens: *Galvano* (Paris). Vol. 24, No. 219, pp. 23-24.

The author discusses the various types of pitting troubles encountered in nickel plating, the causes and means to avoid these troubles. Dealing first with hollow pitting, this becomes noticeable after polishing the plate and arises from nodules in relief on the deposit which detach themselves under the effect of the buff. Craters are obtained whose depth varies with the size of the grains which are encrusted in the deposit. This fault is due to careless and dirty bath operation and the remedy is adequate bath filtration and bagging of the anodes; care must also be taken to exclude dust from the plating shop and particular care must be taken when treating hollow ware that the interior is clean.

Very fine hollow pitting arises from gas occluded in the electrolyte—air, carbon dioxide. Heating the bath will overcome this trouble. Hollow pitting in the shape of commas arises from the hydrogen adhering to the cathode during plating. The deposit forms around the gas bubble. This is the

most troublesome pitting fault in nickel plating and the one most commonly encountered.

Measures to be taken to avoid or at least minimize pitting can be enumerated as follows: (1) Deep baths should be used to avoid raising and circulating the mud in the bath; (2) Anodes should be bagged and the anode surfaces should be distributed in the best possible manner—used and new anodes should be alternated; (3) Racking should be arranged so that the parts are correctly spaced and also placed so that, as much as possible, a uniform current density is obtained over the whole bath and ware; (4) An anti-pitting agent should be used on the basis of 0.1 to 0.2 g./l.; (5) Control should be exercised on the current density, the pH and the concentration of the bath; (6) Drag-out losses, etc., should be compensated for; (7) The bath should be heated above 15°C.; (8) The bath should be filtered at least periodically if not continuously; (9) From time to time an electrolytic purification should be given on nickeled cathode plates, with a current density of 0.3 amps./sq. dm. during the night; (10) Constant supervision must be exercised to avoid pieces of metal falling to the bottom of the bath. The rinse waters should be renewed often, particularly at the stages before the nickel plating bath.

Present Position of Thermal Chromizing — Diffusion Alloying

P. Galmiche: *Galvano* (Paris). Vol. 24, No. 220, pp. 33-35.

The chromizing process has the advantage that a chromium-steel alloy surface is obtained on the steel part, which has all the advantages of a stainless steel or a thick chromium plate. Thus, machining difficulties, which arise in the case of stainless steel, are avoided and, in addition, the use of an expensive stainless alloy throughout the whole mass of the part is eliminated with considerable savings. As against plated chromium, the adhesion of the chromized coating is perfect and the surface does not detach or peel during subsequent forming and shaping operations. Again, the surface alloying obtained by the chromizing process can attain or even exceed 50% chromium and, in some

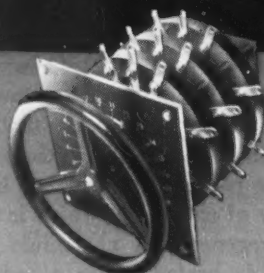
cases, this permits obtaining corrosion characteristics even superior to those of the stainless alloys. Finally and particularly with the gaseous phase chromizing processes, the deposit is extremely regular even in deep recesses and profiled parts.

The author then discusses the Onera procedure which gives a bright chromizing; this is characterized by deposition of the chromium on the parts from the gaseous phase and without exchange reaction by vapor cracking of chromium fluoride gases; these vapors are emitted from a reserve cement supply of chromium fluoride placed in proximity to the parts but carefully screened from these. The pieces are placed in contact or in the proximity of chromium which is termed the regeneration chromium. The assembly is heated under a reducing atmosphere of hydrogen or cracked ammonia. At an elevated temperature, the cement emits chromium fluoride vapors which crack in contact with the iron of the parts being treated, liberating chromium which diffuses into the steel and hydrofluoric acid vapor which attacks the regeneration chromium, thus forming again an equivalent quantity of chromium fluoride. The chromium is utilized completely in this procedure by virtue of the absence of exchange reaction.

The thick chromium diffusion coatings obtained on low carbon steels and iron in this way are very brilliant even if the parts are treated in the initial oxidized condition by reason of the utilization of the fluorine transportation of the chromium in the gaseous phase. On an industrial scale, a time of 1½ hours at 1,075°C. to 1,100°C. permits obtaining diffusion coatings of a useful thickness of 0.1 mm.; by modification of the treatment, diffusion thicknesses can be obtained exceeding 1 mm. By the addition to the cement of volatile compounds which dissociate, such as ammonium carbonate, progressive liberation of the gas from this compound during the heating period will give a surface decarburization if parts of high carbon steel are being treated; however, with very high carbon steel or large size parts, an initial decarburization is preferably given before the treatment.

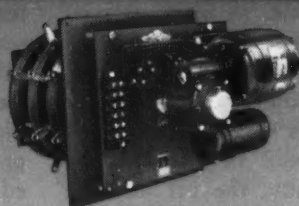
In electroplating, anodizing, and allied processes...

Rectifier Performance Depends on Controls



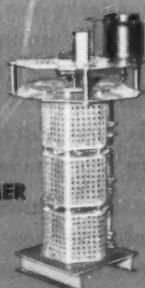
MANUAL TAP SWITCH CONTROL

For both self-contained and remote controlled units. Used in conjunction with a tapped auto-transformer, it provides 22 positions of voltage adjustment from zero to rated voltage.



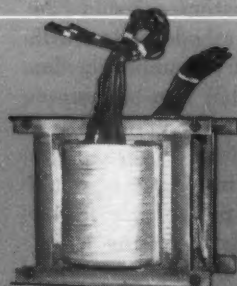
MOTOR-OPERATED TAP SWITCH CONTROL

For pushbutton control of output from remote location. Used in conjunction with tapped auto-transformer and it also gives 22 positions of voltage adjustment.



CONTINUOUSLY VARIABLE AUTO-TRANSFORMER

Either manual for small rectifiers, or oil-immersed, motor-driven for larger ratings. Gives full stepless control from zero to rated voltage. Highest efficiency.



SATURABLE CORE REACTOR

Wholly electrical—no moving parts. Gives smooth control from 10% to 100% of rated voltage, provided 10% minimum current load is drawn.

Need Automatic Voltage Stabilization?

For close DC voltage regulation, automatic voltage stabilization will maintain voltage at pre-set level. Use either sensing panel with motor-driven, oil-immersed continuously variable auto-transformer, or special magnetic-amplifier with saturable core reactor. H-VW-M controls can also provide automatic constant current.

Need Automatic Programming?

Motor-operated continuously-variable auto-transformers, plus timers and controls, will set voltage and operate for pre-set time; change to another voltage at pre-set rate; operate at new voltage for given time, then shut the rectifier off.

The selection of the proper controls with either selenium or germanium rectifiers can be the key to improving your plating and anodizing results. For every installation there is a control which will best fit the application. Let H-VW-M make an engineering survey and recommend the most suitable control to give you not only the best results, but also the maximum in efficiency, flexibility, and economy.

APPLICATION SUGGESTIONS

Use	Recommended Control
Batch Tank Plating	Manual tap switch.
Batch Tank Plating with wide load variations and high production	Motor operated variable auto-transformer or motor operated tap switch.
Barrel Plating	Manual tap switch. No control rectifier.
Cleaning & Pickling	Manual tap switch. No control rectifier.
Conveyor—many stations	Manual tap switch (remote control). Motor operated tap switch. Saturable core reactor. Motor operated continuously variable auto-transformer.
Conveyor—few stations	Automatic voltage stabilization with variable auto-transformer. Automatic voltage stabilization with saturable core reactor.
Chrome strike in combination with Plate	Automatic programming with variable auto-transformer or special series hook-up.
Sulphuric Anodizing	Manual tap switch. Motor operated tap switch. Saturable core reactor.
Color Anodizing	Automatic constant current with variable auto-transformer. Automatic constant current with magnetic amplifier and saturable core reactor.
Chromic Anodizing	Automatic programming with variable auto-transformer. Combination automatic constant current and automatic voltage stabilization with variable auto-transformer or saturable core reactor.
Electrolytic Metal Refining	Automatic current control with saturable core reactor.

3110

PLATEMANSHIP

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

SEND TODAY for free Bulletin ER-108 describing H-VW-M SELENIUM and GERMANIUM Rectifiers and H-VW-M's full line of controls.

HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, N. J.

Plants: Matawan, N. J. • Grand Rapids, Mich.

SALES OFFICES: Anderson (Ind.) • Baltimore • Beloit (Wisc.) • Boston Bridgeport • Chicago • Cleveland • Dayton • Detroit • Grand Rapids • Los Angeles • Louisville • Matawan • Milwaukee New York • Philadelphia • Pittsburgh • Plainfield • Rochester St. Louis • San Francisco • Springfield (Mass.) • Utica Wallingford (Conn.)



H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



Lime Compound

George A. Stutz Mfg. Co., Dept. MF, 4430 Carroll Ave., Chicago 24, Ill.

The above firm announces Radiant White Finish, a non-slaking lime compound which is said to be deterioration-proof. The product can be left open for a month or more without deteriorating, according to the above manufacturer, and will buff equal to, or better than, any lime compound made and kept in fibre tubes for a year.

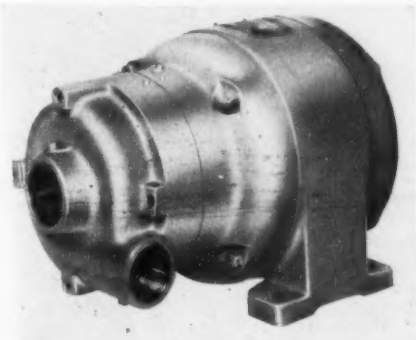
A free sample of the dry, medium, greasy or very greasy type compound may be obtained by writing to the above address.

Centrifugal Pumps

Bart Laboratories, Dept. MF, 225 Main St., Belleville, N. J.

A complete line of centrifugal pumps having almost twice the capacities and head pressures of pumps of equal size and horsepower, is known as the "Flex-Seal". The units are constructed of special stainless steel throughout, for protection against corrosion and product contamination in a wide range of applications.

Other features of the pumps include; double capacity and head pressure ratings operating at 60% to 70% efficiency range; specially designed close coupled junction between pump and motor assemblies which permits quick, easy seal replacement by any shop workman; new "pre-set" two-piece seal, which requires no adjustments after installation; and "on the

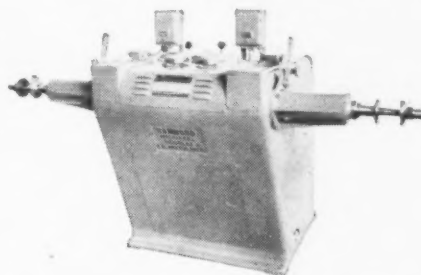


job tested" basic design which, it is reported, reduces maintenance to the absolute minimum and simplifies any servicing which might be required.

Polishing Lathe

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

A new two-spindle, variable speed buffing and polishing lathe with a wider swing, Model VRROW, has a swing of 20" from side of base to face of inner flange, instead of the usual 12" swing of conventional lathes. The two spindles on the new lathe operate independently, each having its own motor and variable speed control. This permits each operator to change wheels or vary speeds without interfering with, or causing down time to the other. Each operator has full 5,



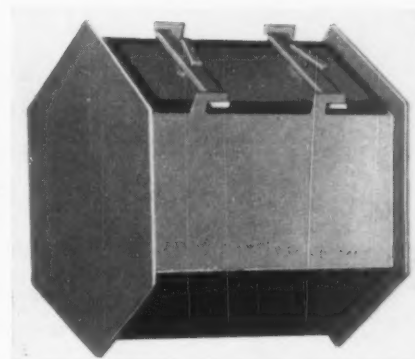
7½ or 10 H.P. on each wheel. Spindle speeds can be changed instantly while lathe is running by turning the dials.

Replacement Tumbling Barrels

Rampe Manufacturing Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, O.

A line of replaceable, precision finishing barrels, ranging in size from 1 gallon to 8 cu. ft. capacity, may be purchased individually for replacement with the firm's equipment or for "Do-It-Your-Self" shops, who wish to build their own tumbling machine. Turn table or flange mounting plates are also available. The company will furnish these barrels with their heavy-duty no-seam vinyl plastic lining, if desired.

The complete list of attachable barrels is as follows:



- 1 gallon — Closed Hexagonal Barrel
- 1 gallon — Open Conical Barrel
- 5 gallon — Closed Hexagonal Barrel
- 7¼ gallon — Open Conical Barrel
- 1.1 cu. ft. — Closed Hexagonal Barrel
- 2 cu. ft. — " " "
- 4 cu. ft. — " " "
- 6 cu. ft. — " " "
- 8 cu. ft. — " " "

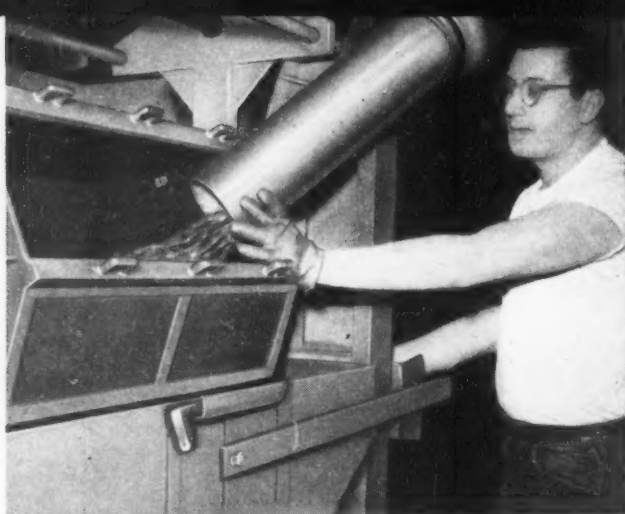
The larger sizes are 23" in diameter — other sizes are smaller. A new 4-page folder describing these high quality barrels will be sent on request to the above manufacturer.

Chromium Fume Suppressor

R. O. Hull & Co., Inc., Dept. MF, 1300 Parsons Court, Rocky River 16, Ohio.

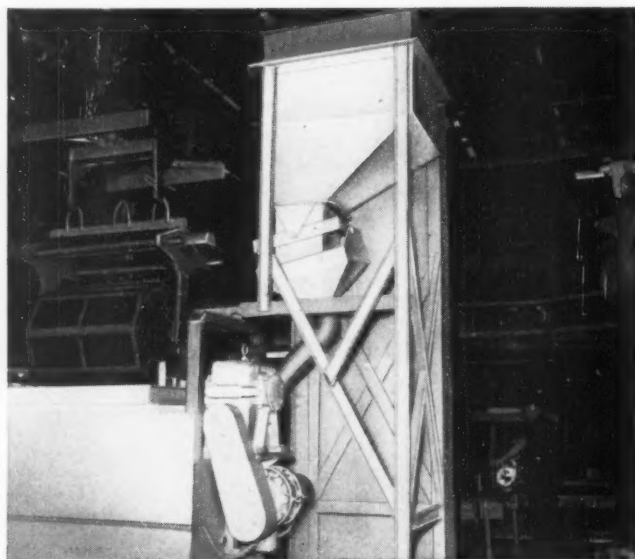
A highly concentrated, liquid product — Super Power No-Cro-Mist — is announced for the most economical and complete suppression of chromium plating fumes to safeguard workers' health, minimize plating rejects, chromic acid consumption, and maintenance of equipment. Its physical effect in pronouncedly lowering the bath surface tension markedly improves covering power, and often as much as 20% lower total current may be used, according to the above manufacturer.

Also available for automatic additions of the above material or other plating additives is a new, polyethylene constructed, Rohco addition agent pump with electrically timed rate control. This pump effortlessly maintains optimum concentration of addition agents with absolute minimum consumption while operating.



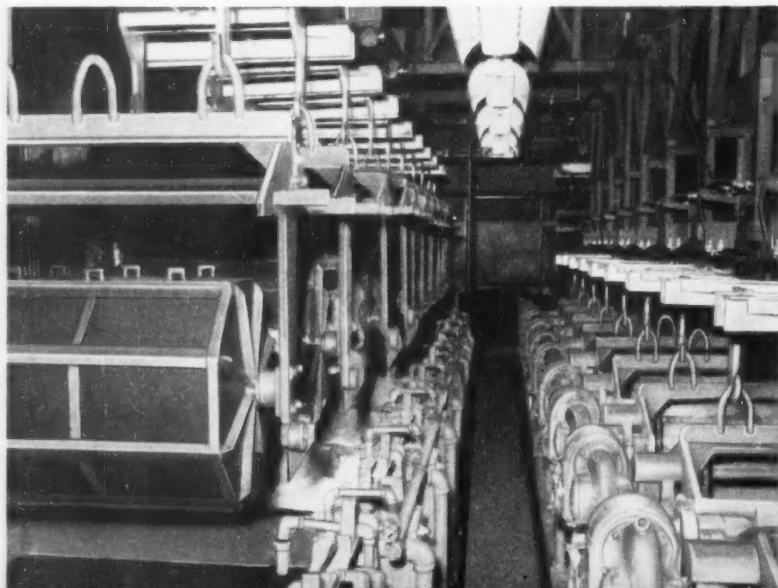
a.

Operator pushes a button and pre-determined amount and sizes of abrasive chips flow through a swivel-chute from an overhead storage bin into the barrel. Work parts are loaded (manually or mechanically), easy-handling door is closed, and the barrel is ready to enter the system.



b.

The barrel rises automatically from the loading-unloading station and is travelled by power-and-free conveyor to head of the finishing lines. An automatic walking beam alternately feeds two submerged-type barrel finishing lines.



Sensational Development in Barrel Finishing...

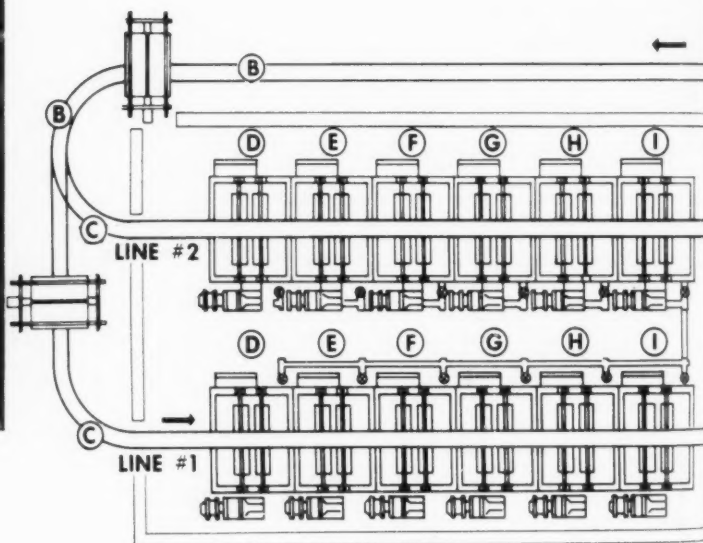
HOW NEW ALMCO AUTOMATED SYSTEM

**CUTS DEBURRING AND FINISHING
COSTS PER PIECE ON 1½ MILLION
PARTS EVERY WEEK!**

● This tremendous savings is being enjoyed by a major automotive manufacturer. The Almco Sub-O-Matic Automated Systems pictured here are deburring and finishing machined, centerless ground metal parts and stamped parts to micro-inch precision.

Tolerance limits on radii are $\pm .0005$, with a 7 to 10 microinch surface requirement. These rigid specifications were formerly very costly to achieve on a mass production basis.

Utilizing the "submerged" type of barrel finishing, the Almco system is meeting these requirements, and cutting costs on *every piece processed*. Follow the story, and see how it's done!



c.

Barrels in each line index simultaneously from one tank to the next at pre-selected time intervals. Descaling, deburring, grinding, burnishing, coloring, rinsing and rust inhibiting are automatically performed in sequence. Upon completion, barrels travel to loading-unloading station.

PRODUCTION FLOW CHART

(diagram below)

Two 6-station submerged lines. The lines are serviced by automatic walking beams... each indexes six barrels every 5 minutes from tank to tank during processing cycle.

Time cycle: 30 minutes per barrel. One barrel of finished parts completed every 2½ minutes.

Barrel size: Barrels are 22" x 28".

FLOW:

A. Loading-Unloading station. Media chips are loaded into barrel by air-operated swivel chute attached to overhead storage hopper. Parts are then placed in barrel and it is ejected from station.

B. Barrels pass along power-and-free conveyor system to start of automated finishing lines.

C. Barrels alternately enter overhead walking beams over lines 1 and 2; each indexes automatically every 5 minutes.

D. First station. Degreasing tank.

E-F-G. Grinding tanks.

H. Rinse tank.

I. Rust inhibiting tank.

J. Parts and media are unloaded to belt conveyor.

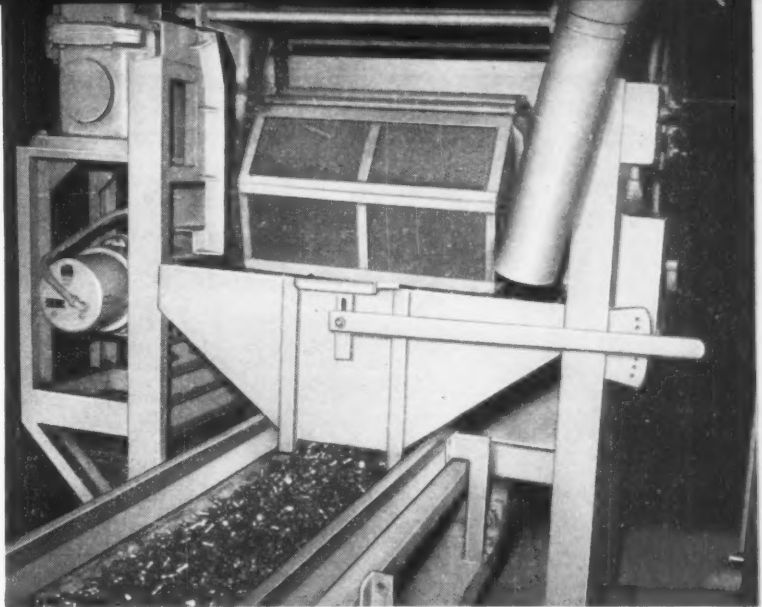
K. Parts are separated from media by magnetic pulley.

L. Pulley raises parts from conveyor where parts are "picked-off" by operators for assembly or storage.

M. Vertical boot-type elevator. Elevates chips to overhead rotary screen classifier.

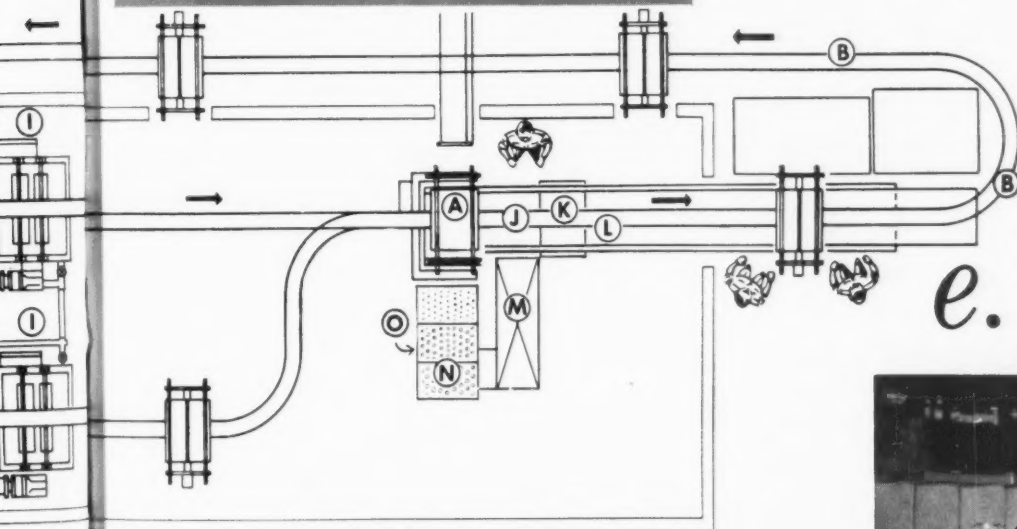
N. Rotary screen classifier. Separates media chips according to size.

O. Overhead hopper. Media chips drop through classifier into separate retaining bins.



d.

Every 2½ minutes in this Almco Sub-O-Matic System, a barrel of completely processed parts is unloaded. This high rate of production is actually equivalent to one man operating 92 standard barrels!

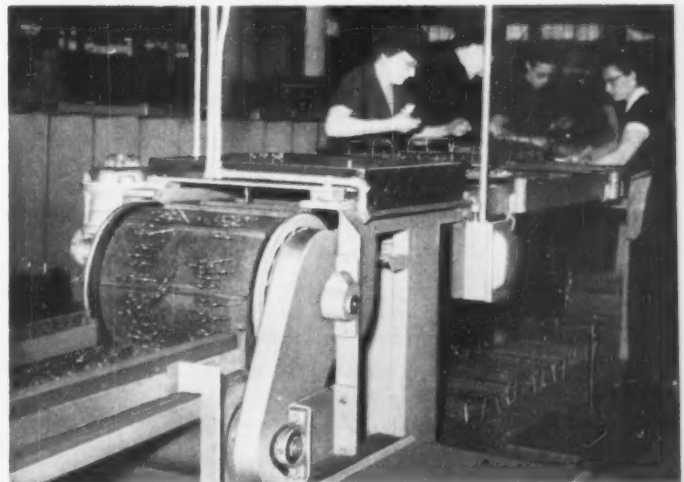


e.

Here, a magnetic pulley separates centerless ground steel parts from the abrasive chips. Parts pass over a demagnetizing coil and are conveyed to a "pick-off" table where operators remove them for assembly. For non-ferrous parts, a vibrating screen replaces the magnetic pulley.

f.

While parts journey to "pick-off" table, the abrasive chips drop from the conveyor belt into a vertical bucket elevator which lifts them to an overhead rotary screen classifier. Chips are separated according to size and are then dropped into respective bins, ready for the next loading.



In pioneering automated barrel finishing, Almco engineers have developed two basic types of Sub-O-Matic Systems, the Skip-Station and the In-Line. Many variations are possible, so that Almco engineers can match your requirements exactly. The completely equipped Laboratory at Albert Lea, Minnesota, displays operating systems for examination, and sample processing of your parts. Write today for your copy of the new Almco Sub-O-Matic Catalog!

ALMCO

DIVISION OF QUEEN STOVE WORKS, INC.

45 Marshall Street • Albert Lea, Minnesota

Engineering offices and Laboratories in Detroit, Los Angeles, New Haven, Newark, Philadelphia, and London, England.



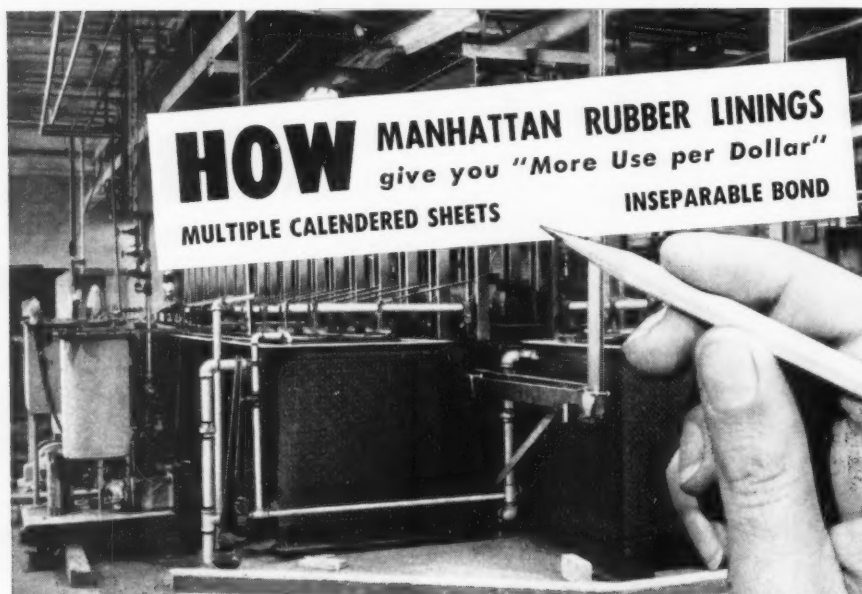


Photo courtesy: Hanson-Van Winkle-Munning Co.

Tests Prove These Linings Can't Be Separated!

Manhattan engineers have developed a method of bonding metal to rubber so securely that actual mechanical pull tests prove it can't be separated. Thick, multiple calendered sheets of natural or synthetic rubber are inseparably bonded by Manhattan lining specialists to assure you permanent protection against the corrosion and abrasion of your equipment or contamination of process solutions. They eliminate the dangers of stray currents in plating operations . . . won't harden or crack . . . even under extreme temperature changes.

Whether your plating equipment is large or small, intricate or simple . . .

Manhattan has the facilities to efficiently handle your rubber lining needs. To make certain your lining is flawless and permanent, every piece of equipment lined by Manhattan is tested under high voltage to detect any possible defects. Many Manhattan Rubber Lined plating tanks have been in continuous use for over thirty years!

Make certain you have permanent protection against corrosion, contamination and abrasion in your costly plating operations. Let the R/M lining engineer at the plant nearest you show you how you can get "More Use per Dollar" with an investment in Manhattan Rubber Linings.

RM 624

RUBBER LINING PLANTS AT PASSAIC, N. J. • NORTH CHARLESTON, S. C.



MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

Strippable Paint Booth Coating

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

Oakite Shield, a new sprayable paint booth coating that strips off in large pieces in seconds, can be applied by either spray or brush to dry booth surfaces. The new material is said to dry fast and to cling tightly to vertical surfaces under paint over-spray. When painting has been completed, the film peels off readily with a minimum of prying with a knife and a minimum of shredding.

The new product is said to have the consistency of paint, to be odorless, non-toxic, and non-hazardous to store and use. Men using it need not wear respirators.

Rectifier Voltage Control

Rapid Electric Co., Dept. MF, 2881 Middletown Rd., New York 61, N. Y.

The Inductrol is a motor-driven, oil immersed, continuously variable, full range voltage control.

Oil immersed in tanks of various sizes to accommodate ratings of 1800 watts and up, the device requires a mere press of a button to provide a continuous, stepless voltage selection. The selection of the proper rectifier voltage output from no load to full load is accomplished smoothly and simply to the full extent of its range. The raising and lowering of rectifier output voltage is safeguarded by sensitive micro-switches to insure auto-



matic shut-off at either end of the range in every instance.

Oil immersion minimizes maintenance, adds to the safety factor, and saves space. The unit also offers the opportunity of remote control operation of the basic rectifier unit.

The control is available in both selenium and germanium rectifier models.

Conversion Coating for Aluminum

Turco Products, Inc., Dept. MF, 6135 S. Central Ave., Los Angeles 1, Cal.

A new process that provides aluminum with a surface conversion coating for protection against corrosion, for improvement of paint adhesion and for ornamentation is called Turcoat 4178, and is claimed to meet Government Specification MIL-C-5541.

Chief advantage of the new process over similar processes is said to be the "quick fix" offered. The new coating becomes fixed and non-smearing immediately upon application, whereas most other coatings will smear or streak if parts processed are handled or moved while still wet. Coated parts can be freely handled and racked while still wet. Drying is unnecessary. Bottlenecks in production lines are eliminated.

The coating formed by the process is of the surface conversion type. It is acid resistant and offers only a very low electrical resistance. It is not brittle. The metal can be bent or formed after the coating is applied. Applied by immersion, spray washer or by conventional hand methods, the coating formed by the new process is a thin, smooth, non-crystalline film

with a slight metallic lustre. The color is a light golden yellow, with red and greenish iridescence.

The process is easy to control, pH being the only critical point. Although standard temperatures and concentrations are observed, these features are not critical, and minor deviations will not throw the process out of kilter.

The process causes only slight sludging. What sludge is formed can be easily handled without interfering with tank operations.

Furnished in dry powdered form, the material is free from objectionable odors and dangerous fuming. It is not hazardous to handle. It is shipped in ordinary containers and is non-caking and convenient to use when received.

Steel Center Buffs

Hanson-Van Winkle-Munning Co.,
Dept. MF, Matawan, N. J.

New steel centers on the above manufacturer's Ruff-L-Buffs make the wheels capable of dissipating frictional heat fast enough to keep the buff cool under all practical operating conditions, it is claimed.

The new center, composed of two steel discs, also provides stronger support for the buffs than the fiberboard centers formerly used. The central section of the buff is sewed together just past the steel area, providing an additional safety feature.

The discs used for the new center have steel clamps that are set deep in the cloth. The discs are multiple spot-welded together. Six ventilating holes assure a free circulation of air from the center of the buff to its periphery.

Due to the success of the new centers, all Ruff-L-Buffs will be manufactured with steel centers after March 1. The company reports that prices on



Get It Wet!

You've got to get water into and all around the soil, if you're going to wash soil off metal parts and surfaces. That's what makes

Cowles

NEW QC WASHING MACHINE CLEANER

a completely different kind of alkaline washing machine cleaner.

Cowles QC Washing Machine Cleaner "wets" the soil faster—loosens it more thoroughly—emulsifies it more completely.

All this . . . without objectionable foaming!

Get the complete story on this brand NEW Cowles QC Washing Machine Cleaner. Send this coupon.

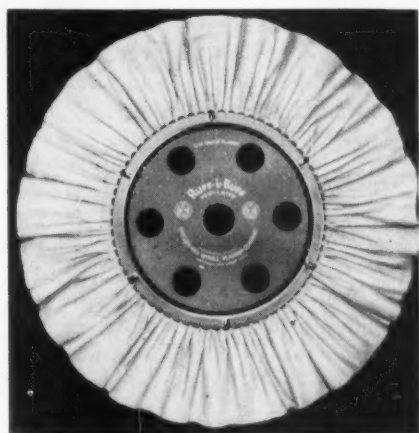
Cowles Chemical Company
7014 Euclid Avenue
Cleveland 3, Ohio
Please send Cowles QC Bulletin

Name _____
Company _____
Address _____
City _____ State _____

Cowles

CHEMICAL COMPANY
Cleveland 3, Ohio

See Cowles' other advertisements on pages 95 and 103.



all lines of these buffs will remain the same.

Tin Flowing Process

Hydro Chemical Co., Inc., Dept. MF, Cooke St., Farmington, Conn.

Bright-Flo Flux is a process designed for reflowing of electrodeposited tin and is claimed to offer good corrosion resistance plus a bright finish. The flux operates at temperatures of 525°F. to 550°F. without difficulty, thereby providing the speed required for high production requirements. The flux is easily removed after reflowing in a single stage mild alkaline cleaner.

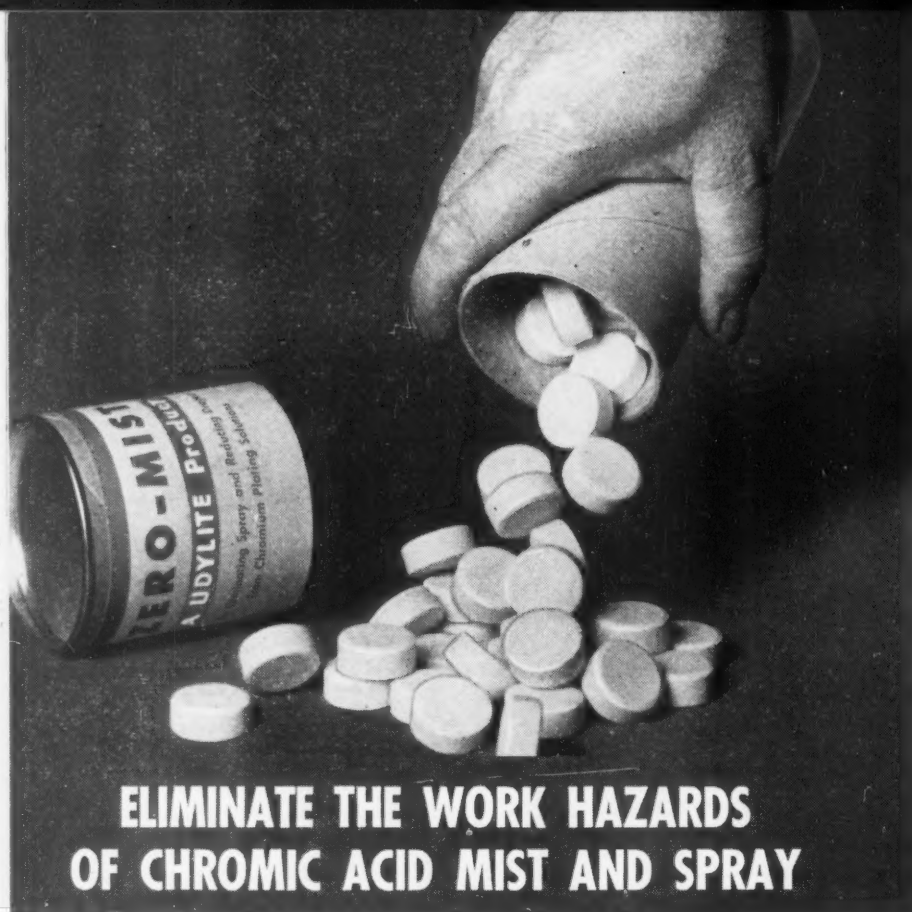
The process has been used successfully on many odd shaped parts.

Rust Inhibitor for Parts-in-Process

Daubert Chem. Co., Dept. MF, 333 North Michigan, Chicago 1, Ill.

It is now possible, through use of a new water-soluble chemical inhibitor, to prevent rust on machined parts and stampings following washing, and during temporary in-plant storage.

The rust inhibitor, called Hydrin, is dissolved in the rinse-water, and affords protection during immersion of the metal and following dry-off. The invisible film remaining eliminates the need for conventional petroleum-type protective coatings, thus permitting easy inspection of the parts, and subsequent machining, painting, or packaging without cleaning.



ELIMINATE THE WORK HAZARDS OF CHROMIC ACID MIST AND SPRAY

... use ZERO-MIST

The health hazard caused by mist and spray from chromic acid plating bath solution is eliminated when you use Udylite's Zero-Mist. Employees like it. City and state labor and health authorities like and recommend it. It is a boon to labor relations.

Beside eliminating mist and spray and improving working conditions, there are these direct benefits to your profitable operations—Saving the losses of valuable chromic acid in mist and spray—Additional large savings in the reduction of dragout losses—No need for water wash system installations—Gives added life to ventilating systems—Protects other solutions from mist and spray contamination.

Zero-Mist is a stable, surface-active additive for decorative chromium plating baths. It is unaffected by high temperatures. The concentration of Zero-Mist stays practically constant.

Zero-Mist is today a *must* in many plating operations. It will pay you to try it. Write us today for a test sample.

THE
Udylite
CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST
PLATING SUPPLIER

Udylite Overseas

Clichy, France

The industry of home appliances has considerably developed in France during 1955 and a good deal of firms have now erected large electroplating installations. In most cases, of course, the bright nickel plating process is used.

In view of the high quality required the parts are copper plated and buffed before being coated with a Udylite Bright Nickel deposit in the order of 15 microns. For more safety, a copper flash is used on the parts which have been copper plated and buffed prior to nickel plating.

It is evident that the use of the Udylite techniques enables the firms to increase the quality of their plating and to fight effectively against the high competition they meet in France.

Rotterdam, Holland

The addition of Zero-Mist to chromium plating baths makes it possible to omit the exhaust and thus results in great advantages. Consequently, we contacted the Labor Inspection in our country after having put into use the first Zero-Mist baths.

Together with a few chemists of the Labor Inspection we visited a number of our clients who were adding Zero-Mist to their chromium baths and took the necessary air samples above the baths. We thus obtained sufficient data to establish the content of chromic acid in the air above chromium baths *without Zero-Mist* and *with a normal exhaust system* and to compare this data with the air samples we took above baths *with Zero-Mist* and *without exhaust*.

It appeared after analysis of those samples, which had been taken on various heights above the liquid surface, that Zero-Mist could not only be considered a complete substitute for exhaust, but also far better and more effective.

These experiments were only made, however, in factories where a well functioning exhaust was available. The air samples taken near baths with exhaust and without Zero-Mist appeared to contain 5 to 20 times more chromic acid than the air samples which were taken after the addition of Zero-Mist.

ADVERTISEMENT

Udylite Overseas—(Cont.)

The additional of Zero-Mist to chromium baths has been semi-officially allowed and other experiments are being taken at 20 other customers.

If the results are successful we shall no doubt be given full permission by the Dutch Labor Inspection to use Zero-Mist in place of exhaust.

Milan, Italy

The Udylite Bright Nickel Process was only introduced into Italy in 1950. Before then brighteners of other origins were used, but results were generally unsatisfactory and their use limited.

The introduction of the Udylite Brighteners proceeded rapidly, facilitated by the experience already gained in other countries.

Our main customers who have experimented with Brightener No. 41 recognise its greater levelling qualities and, particularly, the greater tolerance to contamination from zinc and copper.

Johannesburg, South Africa

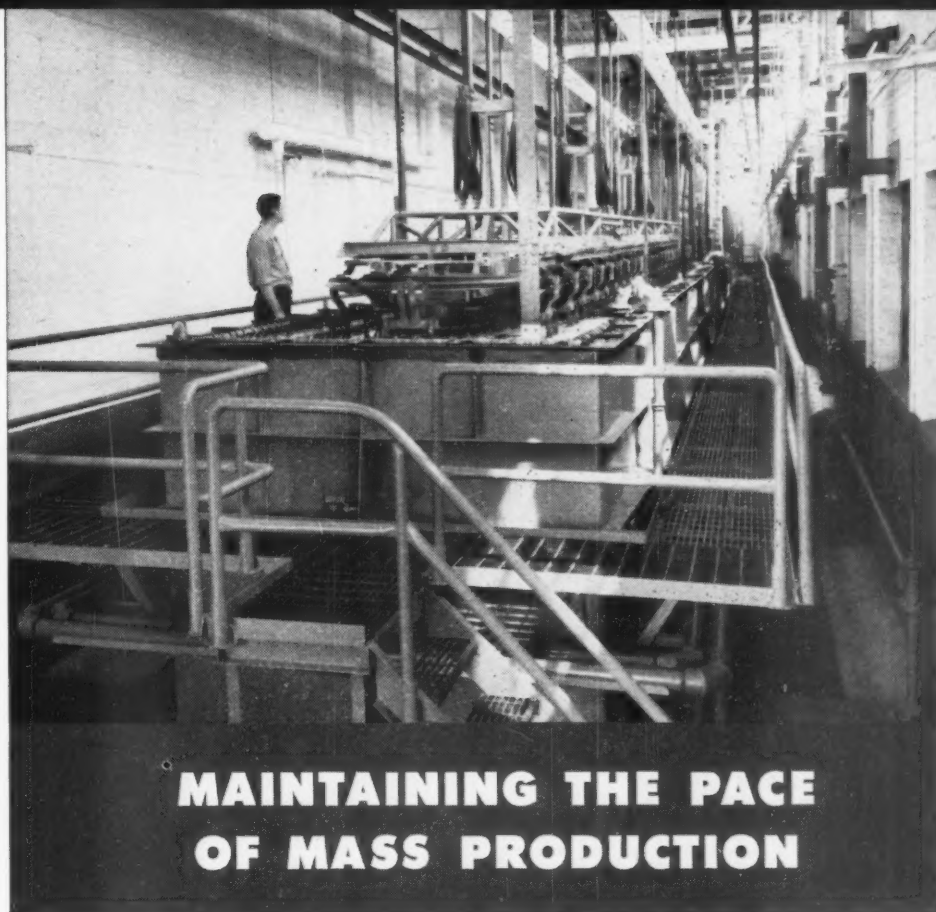
Udylite processes were introduced in South Africa for the first time approximately a year ago when a small bright nickel bath was installed—a tank of approximately 270 gallons. Since that time we have made considerable progress and at the date of this news letter we have 6,000 gallons of Udylite Bright Nickel tanks in operation. We also have several chromium plating tanks operating with Zero-Mist, and these have justified the claims made for this product in every respect.

The electroplating industry in South Africa has made great progress during the last few years and has greatly benefitted by the up-to-date methods and processes used in England and America.

Bienne, Switzerland

Brycad Cadmium: Practical trials on a large scale at one of our more important machine factories have shown that the physical characteristics obtained, whether from the passivated deposit or not, were better than in other deposits obtained in Switzerland. It even seems that the chemical resistance is slightly superior to that of deposits of cadmium from normal baths.

ADVERTISEMENT



This Udylite Machine Cleans, Plates and Processes 480 Auto Grilles per hour AUTOMATICALLY

A complete production operation—applying nickel-chrome plate to steel radiator grilles—is handled by three men and this Udylite machine. The entire operation of cleaning, plating and rack strip are handled by the machine—the loading and unloading of parts are the only manual operations. The stampings are approximately 8" x 36" in size and to assure them of a flawless finish Udylite installed a Horizontal Cathode Agitator. In addition, a high current density chrome strike is applied before the chrome plate.

This is just one more example of how Udylite machines are meeting the pace of mass production. And Udylite machines are adaptable to practically any metal finishing operation you can name. Why don't you find out more about how Udylite can fit into your operations? Just call your nearby Udylite representative or write direct for the full details. There's no obligation.

THE
Udylite
CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST
PLATING SUPPLIER

now

you can get this
brilliant finish
directly on
zinc die castings!

No electroplating--no
mechanical finishing!



PART AS CAST



TREATED WITH NEW IRIDITE

NEW

IRIDITE® (Cast-Zinc-Brite)

brightens zinc die castings by chemical
polishing, protects against corrosion

NOW, FOR THE FIRST TIME you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for **FREE PROCESSING** for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. **IMPORTANT:** when you give us samples for test processing, please be sure to identify the alloy used.

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED

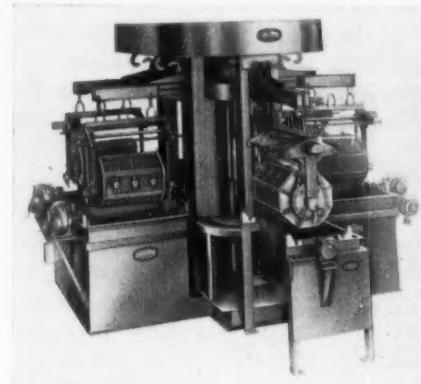
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

Manufacturers of Iridite Finishes for Corrosion Protection and
Paint Systems on Non-Ferrous Metals; A&P Plating Chemicals



Automated Barrel Finishing Systems

Almco, Division of Queen Stove Works, Inc., Dept. MF, Albert Lea, Minn.



Two types of automated barrel finishing systems are claimed to be the first and only in the metalworking industry. The complete finishing process is automatic from beginning to end, controlled by one operator and pre-set switches.

The systems are the Sub-O-Matic Skip-Station type and the Sub-O-Matic In-Line type of automated barrel finishing. The Skip-Station system can simultaneously finish a variety of parts requiring different finishes by automatic programming feature. The In-Line system is particularly suitable for finishing high production parts of different types requiring the same finishes and processes.

Of special importance in the Super-shen Automated systems are the materials handling systems; even delicate centerless ground steel parts can be handled throughout the system without part-on-part impingement. In unloading, the parts and abrasive media are emptied from the barrel to a belt conveyor; parts are then separated from the media by a magnetic separator and then pass through drier unit to a "pick-off" table for assembly or storage.

The media drops into a vertical bucket elevator and is raised to an overhead rotary screen classifier. At this point the different size media pass through the classifier and fall into the retaining bins of an overhead media storage hopper. Up to 10,000 lbs. of media per hour can be handled by this arrangement.

In the Skip-Station automated system, the barrels move from one finishing tank to the next with all barrels indexing at the same time. A special

feature of this system is the automatic programming which permits barrels to by-pass tanks by a pre-selector switch on the control panel. This allows the barrel to "dwell" above the tank until the time cycle is completed; then, the barrel indexes to the next station and enters the finishing tank for processing. In this way, different finishes and processes on various parts can be obtained during the same processing cycle. For example, a load of parts may not require descaling, or burnishing; in this instance, both of the tanks would be by-passed, the barrel would only enter the deburring, grinding and rinsing stations.

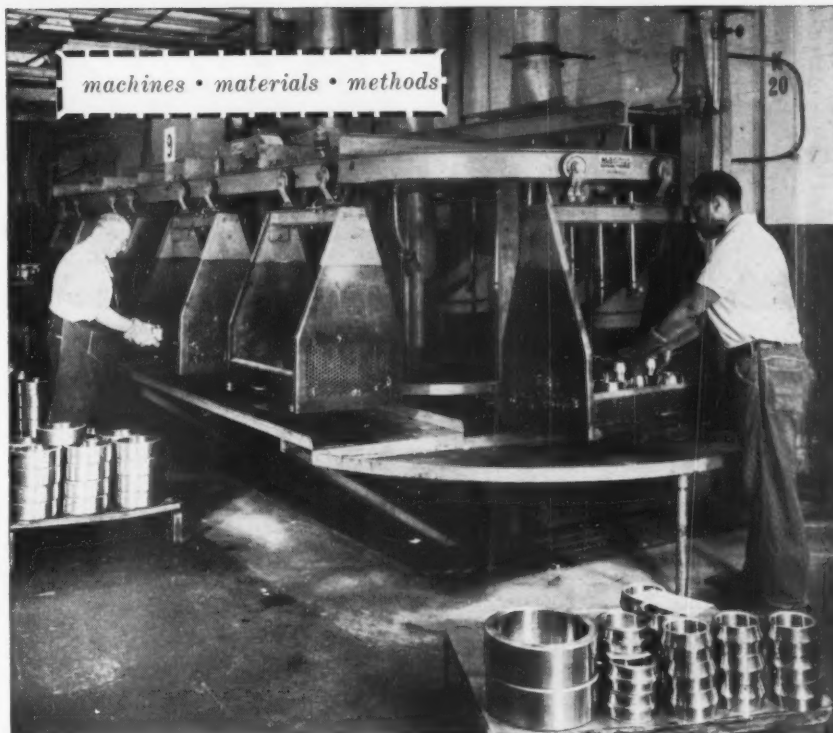
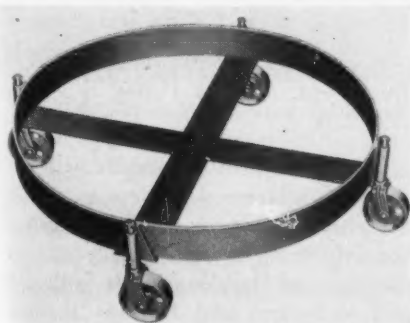
The In-Line systems employ a power-and-free conveyor system to take barrels into the finishing system. Barrels index simultaneously from one tank to the next by automatic walking beam. After completing the process, barrels enter the unloading station where barrels are positioned and emptied by a jog switch. Ferrous parts are separated from abrasive media by magnetic separator; in applications where parts are non-ferrous metal, a vibrating screen is used for the separating operation. The barrel is then reloaded and is ejected into the power-and-free conveyor system which takes it back to the finishing line.

These automated barrel finishing systems can be engineered to meet the requirements of mass production parts that run to hundreds of thousands weekly. Finishing departments now using two or more conventional type finishing barrels in continuous production can also profit by the many advantages of these automated systems, it is claimed.

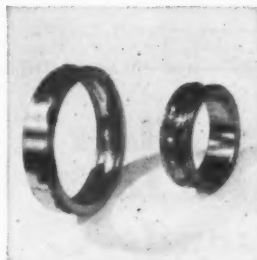
Drum Dolly

Morse Mfg. Co., Dept. MF, 755 West Manlius St., East Syracuse, N. Y.

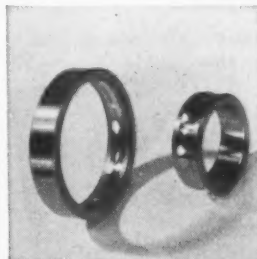
The new drum dolly No. 13 is ideally designed for vertical handling of open end drums. Safety is assured by the deep lip which holds the drum



First Fully Automatic Dip-Immersion-Agitating Cleaning Machine to fit Every Production Line



BEFORE CLEANING



AFTER CLEANING

For the first time, fully automatic, mechanically agitated dip cleaning equipment for washing all types of metal parts can be tied into a fully automatic high speed production line. This modern methods machine in which the parts are rapidly agitated up and down in the cleaning solution and automatically transferred to the next operation, is exclusive with Magnus.

The Magnus Aja Lif Automatic Cleaning Machine, shown in the illustration, is used to remove grinding grease from bearing races. Savings of thousands of dollars per year have been realized by this bearing manufacturer since replacing his vapor degreaser with the Magnus Aja Lif Automatic Machine and Magnus buffing compound remover, Magnus #71.

The right Magnus Method of cleaning . . . the specialized Magnus Cleaners . . . a fully automatic Magnus Machine can be tailored to suit your own production line cleaning requirements.

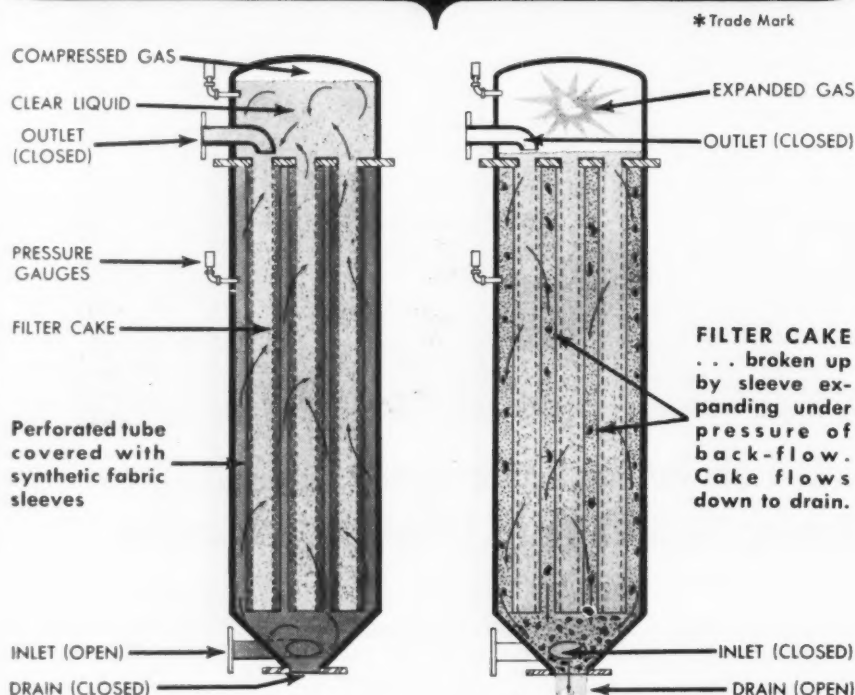
Write to Magnus, 11 South Avenue, Garwood, N. J., for your copy of Bulletin 10,000 G the new 36-page manual on cleaning Materials, Methods, Machines.



INDUSTRIAL DIVISION
MAGNUS CHEMICAL CO., INC.

— a world-wide organization specializing in cleaning and protection of all surfaces.

NEW! *Hydra-Shoc*^{*} SELF-CLEANING FILTER



**Industrial's new tubular filter
creates own air pressure for
fast self-cleaning in seconds...**

- SMALL FLOOR SPACE
- ELIMINATES FILTERED WATER FOR CLEANING
- ELIMINATES BACK FLOW PUMPS

Simply shutting off the outlet valve at the end of a filtering cycle prepares the filter for Hydra-Shoc cleaning. The air trapped in the filter chamber builds up under normal input pressure. Then a set of quick opening valves simultaneously shut off the inlet and open the drain. The air, suddenly released with a hammer-like blow, expands the fabric sleeves, instantly dislodging, and forcing the filter cake through the drain in seconds.

Special bulletin now available showing operating sequence, sectional drawings and principle of operation.

SEND NOW FOR YOUR COPY OF BULLETIN NO. 114-1155.



CENTRIFUGAL PUMPS • PRESSURE FILTERS • ION AND HEAT EXCHANGERS • RUBBER LININGS • WASTE TREATING EQUIPMENT

Industrial

INDUSTRIAL
FILTER & PUMP MFG. CO.

5906 OGDEN AVENUE • CHICAGO 50, ILLINOIS

securely in place. Durability is assured by the cross members which give added strength for load capacities up to 700 lbs. Four 3-inch diameter steel swivel casters make the dolly easy to get into small areas.

Built of 2½ inch steel for long life, the dolly is 24 inches in diameter, with an overall height of 6½ inches. Cost is \$9.90 F.O.B.

Thermodynamic Steam Trap

Sarco Co., Inc., Dept. MF, Empire State Bldg., New York 1, N. Y.



The new Thermodynamic TD steam trap (pat. pending) is now available in the 3/8" size as well as the 1/2", 3/4" and 1" sizes.

Slightly larger than a 50-cent coin, the 3/8" size is well-suited for applications such as tracer lines. Withstands water-hammer and corrosive condensate. Operates equally well on light or heavy loads and against back pressures up to 50% of inlet pressure. Closes tight on no load. Same trap without changes for 10-600 psi.

Practically no maintenance required for this new steam trap which has only one operating part, a solid, hardened stainless steel disc. Only 3 parts: cap, valve disc and body all of stainless steel. No gaskets to leak, no critical clearances to choke. Trial installation is offered by the above manufacturer.

Cadmium and Zinc Brightener

Kosmos Electro-Finishing Research, Inc., Dept. ME, 13 Valley St., Belleville 9, N. J.

The above firm announces Brite-All, a new brightener for cyanide zinc or cadmium plating. A small addition of the brightener is said to improve the character of the deposit for both zinc and cadmium, and lustrous deposits

are obtained even with contaminated baths.

According to the manufacturer, the brightener eliminates high current density burning and improves the throwing power of both zinc and cadmium finishes. Supplied as a concentrated viscous liquid, it can be diluted up to ten volumes and used for optimum finish. The brightener is claimed not to affect the solderability of cadmium plate, and is not toxic as used.

Rust Preventive Spray

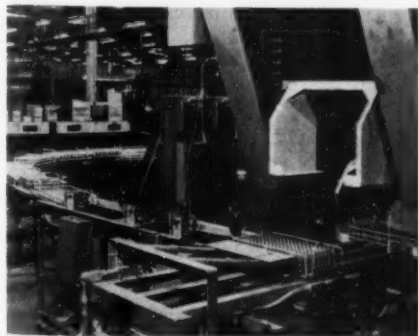
Eastern Aerosol Products, Dept. MF, Newfoundland, N. J.

A rust preventive spray for use on tools, molds, dies, instruments, nested metal parts and machinery is now in production. Distributors and dealers are being appointed in all sections of the country and for export markets.

Known as Rust Chek, the new compound is packaged in a 12 ounce aerosol spray container. According to the above manufacturer, a can provides approximately 80 square feet of coverage in the form of a clear, dry, waxy film to a thickness of 0.0005". Except in the case of use on precision instruments where critical tolerances are to be held, the film need not be removed when the protected tool, mold, machinery, etc. is removed from storage or tool crib and readied for use. The film is worked off in the using, and, in some applications, it serves as a lubricant.

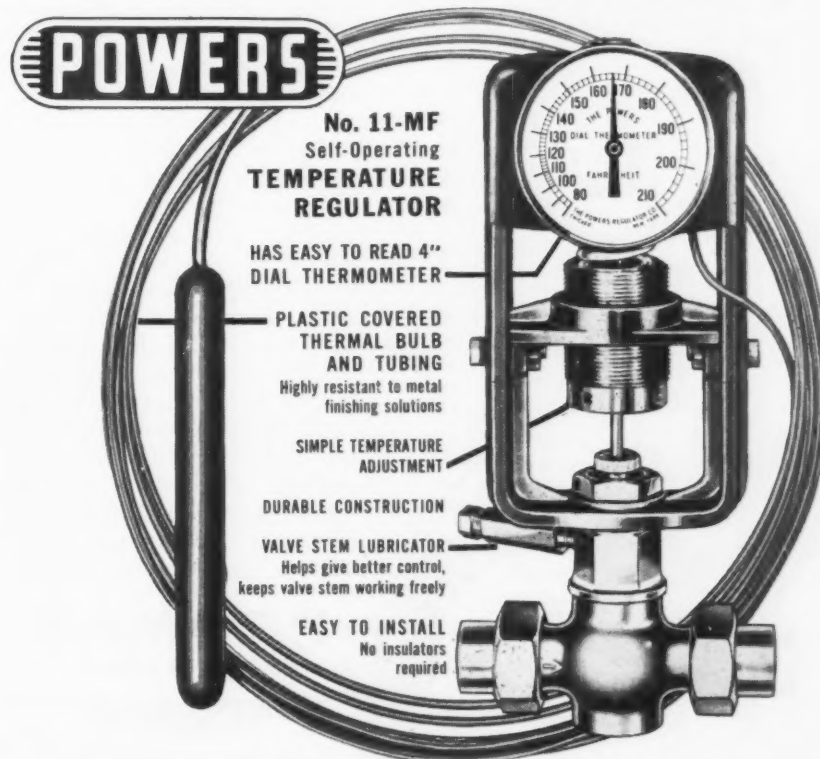
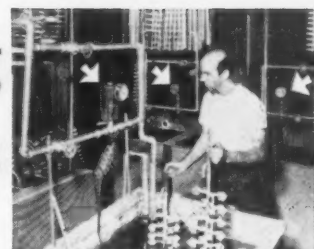
Automatic Basket Feeder and Unloader

Circo Equipment Co., Dept. MF, 51 Terminal Ave., Clark (Rahway), N. J.



A low cost sectional automatic feeder and unloader for transferring product-laden baskets to and from standard conveyor systems and process machinery has been designed to speed, simplify and cut costs of product handling. The automatic feeder and unloader is designed for production-

For Plating, Cleaning and Rinse Tanks



Simplest, Most Reliable Control Made

Holds Temperature at the Right Point
Savings Often Repay Its Cost 3 to 6 Times a Year

Why Powers No. 11-MF Regulator Gives Better Control and Lasts Longer— better TEMPERATURE Control results from powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type. Greater durability of plastic covered bulb and tubing also helps prolong the life of the regulator.

Dial Thermometer indicates temperature of solution under control. It gives a visual check of the process and makes it easy to adjust regulator for different temperatures.

Eliminate "the human element" in temperature control with Powers automatic Regulators. They're simple, compact and dependable. They stop OVER-heating, prevent "boil-overs," waste of steam, water wasted by evaporation, burnt plated parts, rejects, decomposition of costly additives and loss of volatile ingredients from cleaning solutions.

Powers Nationwide Service and 24 Hour Delivery in the U.S.A. are important time and money saving advantages. Order a Powers No. 11-MF Regulator now. Call your supply firm or write us direct for Bulletin 330 and prices.

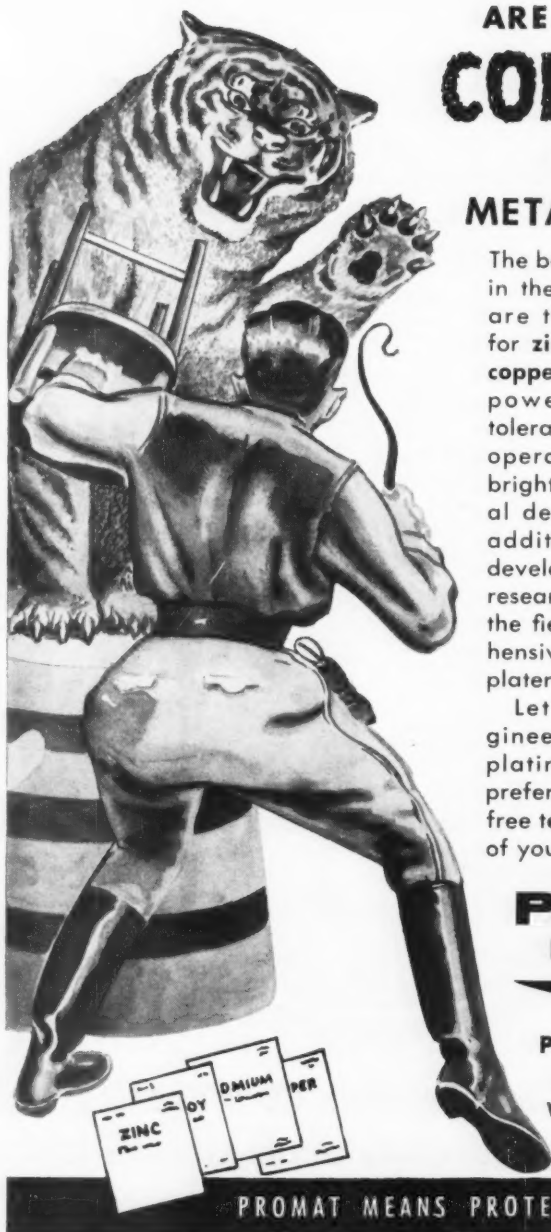
(e43)



THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | Offices in chief cities in U.S.A., Canada and Mexico

Over 60 years of Automatic Temperature and Humidity Control



ARE YOU FIGHTING CORROSION ON YOUR METAL PRODUCTS?

The best weapons you can use in the fight against corrosion are the PROMAT processes for zinc, cadmium, alloy and copper plating. The throwing power, operating ranges, tolerance for impurities, low operating costs and utmost brightness and adequate metal deposition of PROMAT'S addition agents have been developed through years of research and extensive use in the field. PROMAT'S comprehensive line is used by leading platers throughout the world.

Let PROMAT'S service engineers help you solve your plating problems or, if you prefer, write to PROMAT for free technical bulletins on any of your specific plating needs.

**PROMAT
DIVISION**

POOR & COMPANY

851 S. Market Street
WAUKEGAN, ILLINOIS
Dept. MF-5

PROMAT MEANS PROTECTIVE MATERIALS!

line rate loading and discharging of baskets into and from automatic washers, conveyorized degreasers, inspection pre-treating systems, dryers, heat-treating equipment, etc.

Built to standard specifications, both the feeder and the unloader can be easily adapted to virtually all conventional and many custom engineered processing systems now being fed through less efficient manual or semi-manual means.

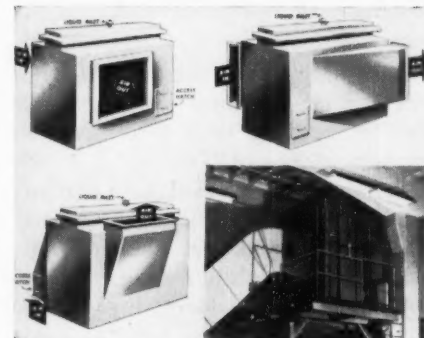
The feeder section and unloader section are available as independent units for basket movement involving one-stage basket transference from one conveyor to another, or for simple flow-line switch-over. Both units come complete, are internally coordinated to prevent out-of-step feed, and can be

operated at any practical speed. Limiting devices and safety stops are integrally linked with the systems they service to shut down and signal a fault if it occurs.

Air Wash Systems

Automotive Rubber Co., Inc., Dept. MF, 12500 Beech Road, Detroit 39, Mich.

A new line of ARco rubber lined, acid-proof air washers, designed specifically for integration into plant ventilation systems, are said to be capable of eliminating 90% to 99% toxic fumes and corrosives from exhaust gases. The washers are equipped optionally with straight-through air inlet and discharge; with bottom air



inlet and top air discharge; with end inlet and end discharge and an added downstream access hatch. Standard units are available in capacities from 7,200 to 57,600 C.F.M.

Fabricated of $\frac{3}{16}$ " steel plate, the cross flow type washers are full welded inside and out. The steel shell is sand blasted and lined with sheet rubber. All outlets are face-lined with rubber continuous with the inside membrane. These units have no moving parts and are reported to be extremely economical in operation.

Each washer is provided with a lengthwise sump approximately 10" x 12" and flanged 2" side outlets for connection to recirculation system, overflow line, quick dumping line, steam line for outside installation winter heating, make up water line and quick-fill line. One flanged 2" top inlet leading to the distribution system is also provided. One 16" x 24" access hatch is a standard component on each of these units. Other accessories are provided to meet special conditions and specifications. The liquid distribution system is of gravity feed, overflow type. This is claimed to prevent clogging and to eliminate back pressure on the recirculation or water feed line. Saddle type tower packing brings the scrubbing liquid and the air, fumes, or other gas into intimate contact within the washer unit. Sometimes, raschig ring packings can be used with almost equal success.

The essential operating principle of the washers is centered in the bed irrigation method. A vertical packing bed is irrigated from the top with a liquid, usually, though not necessarily, water. Liquid is distributed throughout the bed from calibrated drip points producing uniform wetting. This presents a blanket of wet surface area to the passing air or other gas.

The liquid, or water, flows over the surfaces of the packing in thin, low surface tension films. This facilitates

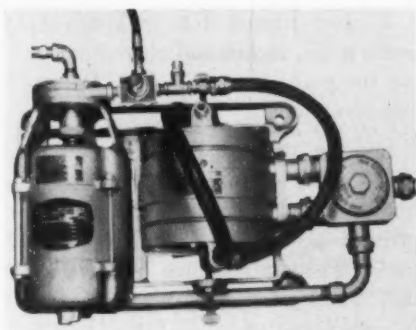
penetration of the film surfaces by vapors, fumes, or dust particles in the gas stream. In turn, the gas stream is broken up into a multitude of small ribbons. Ribbons are forced to follow a roundabout route producing many minute cyclones and whirlpools. This causes sudden changes in the direction of small gas streams, and starts continual intermingling of streams as passage is made through the wetted bed. Dead space, filled with tower packing, is provided at the top of the unit. This assures complete distribution of liquid evenly over the length of the packing bed and prevents gas, dust particles, and fumes from bypassing the bed.

Also available is the counter-flow packed column unit, which involves the accepted design features of the counter current flow type of packed column construction. This unit is engineered to handle service conditions requiring the additional efficiencies and operational advantages inherent in counter flow systems for cooling, drying, absorption, scrubbing, and other requirements.

Construction materials employed in these units in broad variety are available to suit particular service conditions involving high temperatures, oxidizing solutions, fluorine, and HF.

Hot Spray Pump

Spee-Flo Co., Dept. MF, 720 Polk, Houston, Tex.



A new Mark III centrifugal pump, is now standard equipment on all Circaflo models.

The new pump incorporates a PermaSeal assembly which virtually eliminates dependence on the human element for service attention, and operation with the most abrasive materials is now possible without manual attention.

Further information on this pump may be obtained by writing directly to the above address.



**GET
BEHIND
IT!!**

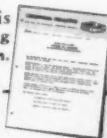
Put your metal cleaner *behind* the soil—between the soil and the metal—and you'll soon have the soil *off* the metal. That's the way you'll clean metal parts with . . .

Cowles NEW QC WASHING MACHINE CLEANER

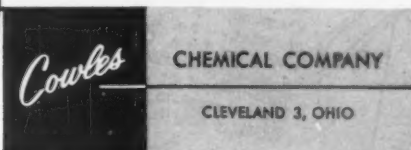
Cowles NEW QC Washing Machine CLEANER penetrates through films of oil—crusts of drawing and stamping compounds—even into deeply recessed parts—pries the soil loose where pressure jets can't reach.

Improved penetrating, wetting, and emulsifying action in your washer without objectionable foaming.

GET THE COMPLETE STORY on this brand NEW Cowles QC Washing Machine Cleaner. Send This Coupon.



Cowles Chemical Company
7014 Euclid Avenue
Cleveland 3, Ohio
Please send Cowles QC Bulletin
Name _____
Company _____
Address _____
City _____ State _____



See Cowles' other advertisements on pages 87 and 103.

Tarnish Preventive

PSC Inc., Dept. MF, 303 Fifth Ave., New York, N. Y.

A single application of the material by the new company's process (patents pending) is claimed to bond it to metal surfaces in a thin, transparent layer. This coating is slated to preserve the metal's natural brilliance and prevents tarnish, oxidation, corrosion and stains on silverplate, chromium, steel, aluminum and other ferrous and non-ferrous metals.

The finish will not peel, crack or chip, according to the company, even when stamped or hammered in the intermediate stages of manufacturing metal products. It is highly heat re-

sistant, and its ductility is greater than that of many metals.

The new product can be used on plated, anodized or plain surfaces and on metals containing organic dyes or inorganic dye coatings, according to the above company.

Cold Spray Cleaner

Klem Chemicals, Inc., Dept. MF, 14401 Lanson Ave., Dearborn, Mich.

A new low cost cold cleaner for spray washers is claimed to offer greater effectiveness as well as simpler operation. It is identified as Klem Kleaner No. 258.

The cleaner is a one package product. Unlike competitive cold cleaners which require the mixing of two or

*add unrivalled prestige
to your product with*

Electroplated GOLD FINISH

Cost of electroplating gold is fully in line with your other production costs — yet brilliant tarnish-proof gold adds permanent richness and intrinsic value you can achieve no other way.

With no more than mild damp-cloth cleansing, gold finish retains its beauty indefinitely. Besides decoration of elements of household appliances, electroplated gold is recommended as a complete over-all finish for toasters, percolators, clocks, small radios, etc.

Technic Inc. equips you with controlled apparatus and electroplating solutions to maintain exacting standards and close tolerances. We design and install your equipment for electroplating gold without waste — and our engineers stand by until performance is assured. Consult us without obligation, whether in respect to a new installation or an existing system now in use.

Att: DESIGN ENGINEERS

INDUSTRIAL GOLD has unique and diverse properties — physical, thermal, chemical, electrical, optical, corrosion resistant — not found in combination in any other form. One of these properties — or a combination — may do a hitherto "impossible" job for you, or economically replace steps in your present operation. Write for data sheet: "Electroplated Gold"

TECHNIC, INC.
39 Snow St., Providence, R. I. JACKSON 1-4200
Chicago Office — 7001 North Clark Street

THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

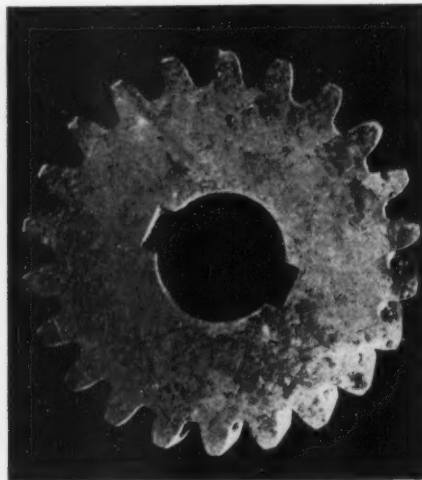


more ingredients in proper proportion to the water, the new cold cleaner is

a compound—all prepared. It is simply added, 1½ to 3 ounces to the gal-



Before



After

lon of water and is ready for use. It does a thorough job of removing all types of soil including cosmoline type rustproofing compounds. One of the outstanding claims made for it is its rustproofing qualities.

Maintaining control of concentration is another advantage of the new product as compared with the guesswork involved with the use of cold cleaners and emulsions. Foaming, which has been a major problem of the present cold cleaners in modern equipment with violent agitation and high pressures, has been controlled with the use of No. 258. It has an exceptionally long life and needs minimum additions to maintain concentration.

Porosity Test Paper

R. P. Cargille Laboratories, Inc.,
Dept. MF, 177 Liberty St., New York 6, N. Y.



A new means for making rapid tests on tin, nickel and chromium plating for pores is provided by Detect-O-Pore test paper.

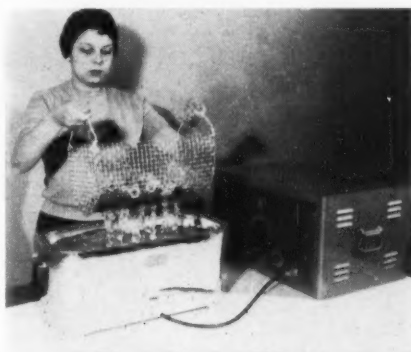
For use, this test paper is moistened with buffer solution, made with a buffer powder furnished, and then pressed down on the surface to be tested. Pores are shown by dark spots that develop on the paper. This test is very sensitive.

The test paper can also be used to indicate the metal under plating because iron and steel give a greenish blue color, copper and brass give a brown color. Also, the same test paper indicates pin holes in enamel, or other protective coating, over these metals and it shows up minute rust spots on stainless steel.

It is furnished in strips 50 feet by 1½" wide in an opaque plastic dispenser that is easy to use and that protects the sensitive test paper.

Ultrasonic Equipment

General Ultrasonics Co., Dept. MF,
1240 Main St., Hartford, Conn.



A new fully-protected ultrasonic transducer for cleaning, degreasing, pickling, plating and other physical and chemical processes, the Type T-2 Sonicell, is completely sealed, metal jacketed, stainless steel lined and thermostatically protected.

Its stainless steel treatment chamber permits use of a wide variety of process liquids. Provision is made for draining and recirculating process liquids during operation.

The treatment chamber is 20" long, 8" wide and 6" deep with a liquid capacity of 2½ gallons.

Its resonant frequency of 20 Kc/sec. provides maximum cavitation energy above the range of human audible perception. It is powered by this company's Model 400 ultrasonic generator which is continually variable in frequency from 10 Kc to 1,200 Kc and which has an output of 400 watts.

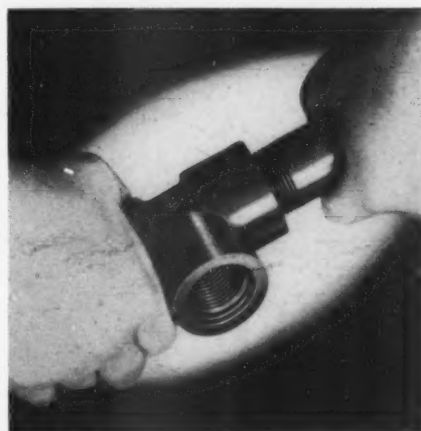
Plastic Pipe

American Hard Rubber Co., Dept. MF, 93 Worth St., New York 13, N. Y.

Rivclor, a new rigid pipe extruded of a special high-strength polyvinyl chloride compound, offers an unusual combination of chemical resistance, high bursting strength, and toughness. Being unplasticized PVC, the material is completely resistant to an astonishingly long list of chemicals, and remains tough and non-brittle even at sub-zero temperatures. This factor makes it easier to cut thread and assemble without breakage or damage, and enables the pipe and fittings to withstand considerable mechanical abuse.

The glossy smooth inside surface of the pipe reduces head loss, and permits greater flow than equivalent size steel piping. Abrasion resistance is excellent.

Pipe and fittings are now available in sizes from ½" to 2", standard or extra heavy wall construction (schedules 40 and 80 IPS.) Working pres-

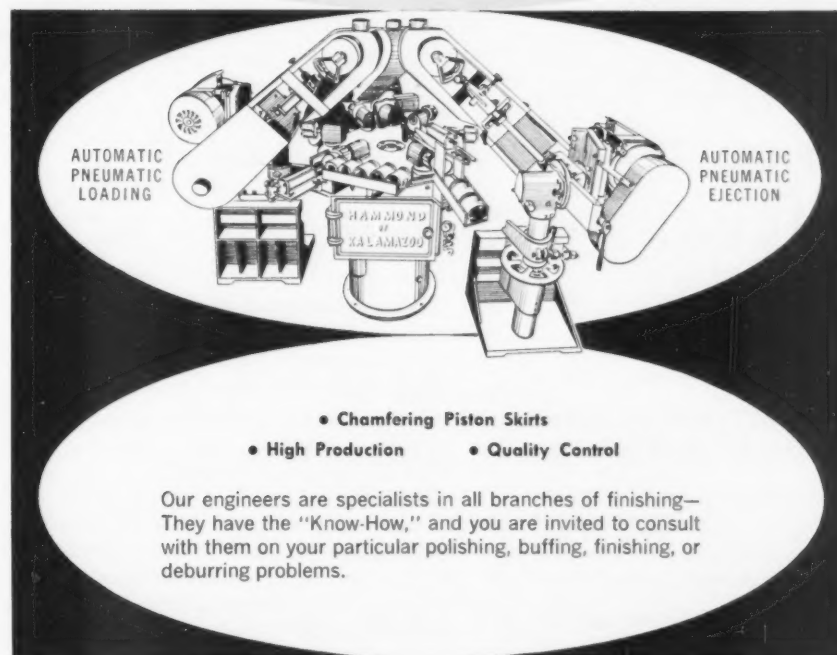


sure of the ½" extra heavy pipe is 490 psi., and that of the 2" extra heavy pipe is 255 psi., at 70 deg. F. Though recommended maximum pressure decreases as temperature goes up, the pipe can be used safely and will retain rigidity at temperatures as high as 160 deg. F. under most conditions.

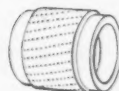
Diaphragm valves are also available with all-Rivclor body.

The material is only 1/6 the weight of steel, and ½ the weight of aluminum. It can be cut easily with a hack saw, and threaded and assembled with standard pipe tools. It also can be fabricated by hot gas welding and solvent cement welding. Welded tank liners and special fabricated equipment are also offered.

Hammond of KALAMAZOO AUTOMATION



Our engineers are specialists in all branches of finishing—They have the "Know-How," and you are invited to consult with them on your particular polishing, buffing, finishing, or deburring problems.



Other parts are being "Automated" on Hammond Automatics.



Hammond Machinery Builders 1601 DOUGLAS AVE. • KALAMAZOO, MICH.



LINEUP FOR TOP-QUALITY TROUBLE-FREE SILVER PLATING

GET ACCURATE RETURNS FROM YOUR *Refinings*

You make sure of accurate returns from your silver plating solutions and other precious metal scrap, sweeps and waste, when you send them to Handy & Harman. Scientific methods, skilled technicians and over half a century of experience assure the recovery of every bit of precious metal value from every lot, large or small. Send us your next shipment and let the return speak for itself.

Yes, you can count on the best in plating results—from both a quality and a cost standpoint—when you do your plating with Handy & Harman Silver Anodes.

That's because, regardless of form, all Handy & Harman Silver Anodes are 999+FINE. This means that all are fabricated of the same super-fine silver by an exclusive production process that maintains highest standards of fineness, removes every trace of impurities detrimental to plating, and assures unvarying uniformity. Once you try them, we're confident you will join the long list of manufacturers who use Handy & Harman 999+FINE Silver Anodes exclusively.



HANDY & HARMAN

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Bridgeport, Conn. • Providence, R. I. • Chicago, Ill. • Los Angeles, Calif. • Toronto, Canada

SHIP REFININGS
TO THE NEAREST
OF THESE PLANTS

WEST COAST 3625 Medford St. Los Angeles 63, Calif.	CENTRAL U. S. 1900 West Kinzie St. Chicago 22, Ill.	EAST COAST 82 Fulton St. New York 38, N. Y.	44 West 46th St. New York 36, N. Y.	Bridgeport 1 Conn.	425 Richmond St. Providence 3, R. I.
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BUSINESS ITEMS

Wyandotte Chemicals Adds Two Sales Representatives

Gerard S. Clooney and Andrew J. Lutz are now representing Wyandotte Chemicals' Industrial and Aircraft Sales Dept. Mr. Clooney headquarters in the company's St. Louis office — Mr. Lutz in the Kansas City office.

Mr. Clooney graduated from St. Louis University and has also studied at Washington University (St. Louis). He served 3 years in the U. S. Army and has had both retail and industrial sales experience.



Gerard S. Clooney



Andrew J. Lutz

Messrs. Clooney and Lutz recently had intensive schooling in modern cleaning procedures at the firm's research laboratories. Both men have been given comprehensive service training by experienced company industrial field and technical service representatives. Mr. Lutz has received additional specialized training for servicing aircraft and petroleum accounts.

Larger Facilities for Udylite

The Udylite Corporation announces the opening of new and larger facilities to serve the New York area.

The office and warehouse are now located at 58-25 Queens Blvd., Woodside 77, New York, Telephone DE-fender 5-6300.

Sommerville Named Sales Representative for H-VW-M St. Louis Territory

Hanson-Van Winkle-Munning Co. has announced the appointment of Arthur W. Sommerville as sales representative for the company's St. Louis area. In this capacity Mr. Sommerville will be responsible for sales activities in the states of Kansas, Missouri, Arkansas, Oklahoma, Texas and Louisiana.

Mr. Sommerville's qualifications for this position include four years with Van Norman Co. of Springfield, Mass. As division manager of this company's Kansas City office from 1951 to 1955 he was in charge of sales, service and instruction for metalworking machines for Van Norman in the West and Southwest.

Prior to this he was district manager for the St. Louis office of Gates Rubber Co. of Denver.



Arthur W. Sommerville

Mr. Sommerville attended Washington University in St. Louis. During World War II he was a lieutenant in the Army Field Artillery from 1943 to 1946, serving as an electronics instructor.

Sel-Rex Products Division Expands Facilities

Sel-Rex Division has established new offices in Detroit. Sales coverage as well as dealer-distributor liaison for company products will be under the direction of S. S. Wilson, sales manager and will extend throughout the midwest, including Michigan, Minnesota, Indiana, Illinois, Ohio, Wisconsin and Iowa. The move to new quarters entails the expansion of warehousing and service facilities.

Products and equipment to be handled through the Detroit office are selenium and germanium rectifiers, filters for liquid clarification and solids recovery, the compact portable plater and the entire line of Sel-Rex precious metals plating salts and solutions.

Mazia Re-Enters Consulting Field

Joseph Mazia, consulting engineer, has re-opened his offices at 1605 Connecticut Ave., N.W., Washington 9, D. C., telephone COlumbia 5-4326.

Davies Supply Elects New Officers

Davies Supply and Mfg. Co., St. Louis, Mo., has announced the election of new officers. A. S. Burnett was elected to the office of vice-president, replacing R. H. Bobilin who is no longer associated with the firm. Mr. Burnett joined the company in 1947 as sales engineer. He will continue to serve in this capacity and also devote

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257-E

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PLASTICS AND SYNTHETICS DIVISION

U. S. STONWARE
AKRON 9, OHIO



A. S. Burnett

a part of his time to the design of new racks and tanks. E. F. Conroy, Jr., was elected executive vice-president, a newly created office. Mr. Conroy formerly held the office of vice-president.

Those re-elected were L. A. Davies, president and treasurer, and C. E. Miller secretary and assistant treasurer.

Bruno Leonelli Named Vice-President By Wagner Brothers, Inc.

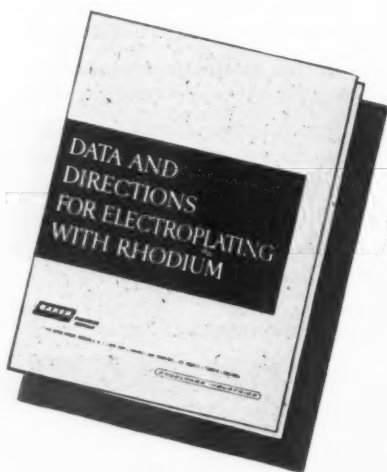
Bruno Leonelli has been elected vice-president of Wagner Brothers, Inc., Detroit manufacturers of plating and metal finishing equipment and supplies.

Mr. Leonelli obtained his Ch. E.

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Bruno Leonelli

degree at Wayne University, Detroit, in 1939.

His experience in the metal finishing field includes six years with the Ternstedt Div., General Motors, where he was chief chemist of the analytical laboratory; seven years at Promot Div., Poor and Co. as division manager; and director of research and development at Wagner Brothers after joining that firm in 1954.

Mr. Leonelli will continue to head up product and process development activities at the company.

New Assignments in Federated Metals

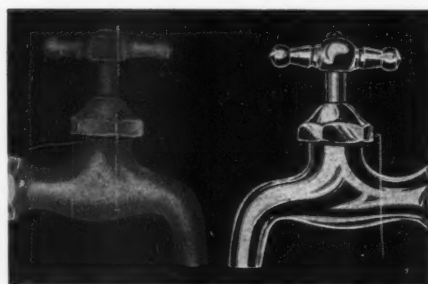
New assignments for three executive engineers in the *Federated Metals Division of American Smelting and Refining Co.* have been announced.

B. E. Anderson assumes the position of chief engineer of the division with headquarters in Salt Lake City, Utah. Arthur F. Kohn, Jr. has become assistant to the general manager of the division with headquarters at Perth Amboy, N. J. Robert Dean Mathis is named superintendent of the Los Angeles Plant of the division.

Mr. Anderson is a mechanical engineering graduate of the University of Utah, class of 1935 and began work with ASARCO at the Garfield, Utah, plant while still an undergraduate. He has had a variety of assignments with the company which have included design and construction at Corpus Christi and Perth Amboy, plant engineer at Tacoma for eight years and recently, project engineer for Federated Metals Division for the construction of plants nearing completion at Toronto and Montreal, Canada.

Mr. Kohn joined Federated in 1935, a year after graduation from the University of Michigan with a degree in chemical engineering. He has worked at the Chicago plant, the Whiting, Ind. plant and, in 1943, was made superintendent of the Los Angeles plant, which position he held until his new appointment.

Mr. Mathis is a 1944 industrial engineering graduate of the University of Washington and has been with the company since that time. He became a metallurgist in 1946 at the Los Angeles plant and assistant superintendent in 1951.



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W. C. BRATE COMPANY

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Diversey Corp. Promotes Dr. Berst

The Diversey Corp., Chicago has announced the promotion of Dr. Neil W. Berst to director of research laboratories. In his new position, Dr. Berst will coordinate and guide new product development, improvement of current products and evaluations of competitive products.

Dr. Berst joined the company in 1951 as group leader in charge of organic research. In 1954 he was selected to attend the Oak Ridge Institute of Nuclear Studies with 31 other leading scientists. His experience in the atomic energy field proved valuable in directing the firm's expanding research program utilizing radioactive isotopes. In 1955 he was named acting director of research laboratories and continued in that capacity until March of this year.

Tect, Inc. Appoints Moran

Appointment of William F. Moran, Jr., as sales engineer for Tect, Inc. of Dumont, N. J. was announced recently.

Mr. Moran is a graduate of Dartmouth. He taught chemistry at Cheshire Academy in 1946 and 1947, then was employed in turn by Hartford Accident & Indemnity Co. and Employers' Mutual of Wausau from 1947 to 1951.

For the past 4½ years Mr. Moran has been representing Diamond Alkali Co. in the Southern States. He will represent Tect in offering its line of safety solvents, stills, and solvent



William F. Moran, Jr.

vapor degreasers to industrial plants. He will also assist manufacturers in finding solutions to their toxicity problems.

Export Managers Appointed by Atlas Mineral

The Atlas Mineral Products Co. of Mertztown, Pa., announces the appointment of *Ballagh & Thrall, Inc.*, 1010 Schaff Bldg., 1505 Race St., Philadelphia 2, Pa., as export managers effective April 5, 1956.

Ballagh & Thrall will manage the sale of all Atlas products for export to all countries except Mexico and the United Kingdom.

The account will be under the personal direction of *Paul J. Marshall*, a vice-president of the firm.

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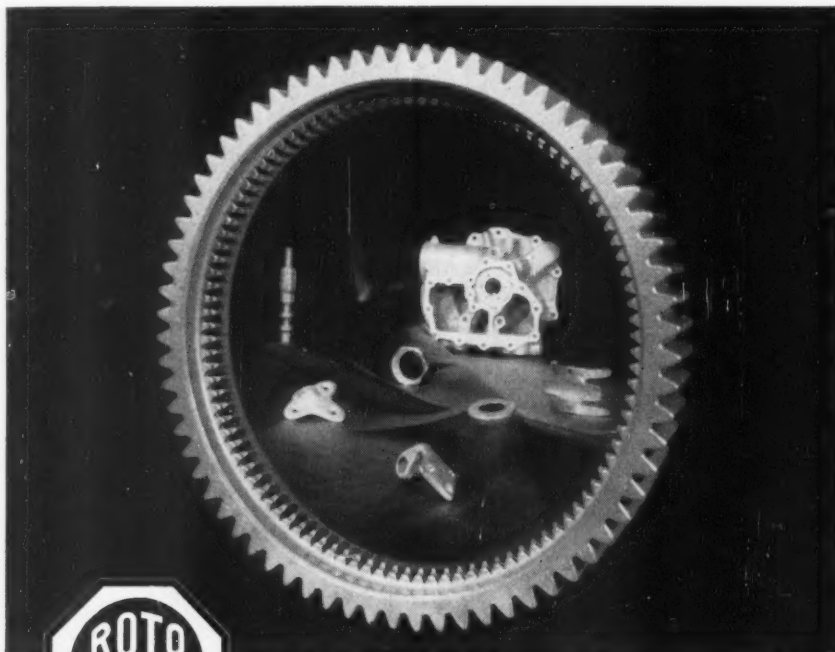
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New Central Territory Office and Plant for American Chemical Paint Co.

The American Chemical Paint Co. announces that it has acquired office and plant facilities at St. Joseph, Mo. and expects to be operating there about June.

The new centrally located office and plant will serve a territory lying between the Mississippi River and the Rockies and from Canada to the Gulf of Mexico.

Heading up the St. Joseph branch will be J. H. Abrams, associated with the company for many years in a supervisory capacity in its Pittsburgh territory. In addition, technical representatives will provide technical serv-

ing and consultation for customers in the new Central U. S. territory.

Diamond Alkali Expands Technical Service Section

Expansion of the technical service section of the Chromium Chemicals Division has been announced by Diamond Alkali Company. E. L. Combs, supervisor of chromic acid sales for the past two years, will head the group, which is responsible for customer service and related laboratory work covering the application of the firm's chromium chemicals in the metal-finishing industry. He will continue to have his headquarters at the company's national offices in Cleveland.

Other members of the group are Joseph P. Branciaroli, technical serv-



E. L. Combs

ice representative since November, 1952, and Robert C. Smith, research chemist for the past four years. Both men will continue to be located at the Research Center in Painesville.

Also announced at the same time were the promotion of Alexander E. Teyral to the post of project engineer, the appointment of J. Edwin Bride to the division's technical sales staff, and the resignation of Charles W. McConnell.

Group leader in charge of development for the Division since November, 1953, McConnell is leaving the company due to his wife's health. He and his wife are now moving to Florida.

Combs, who joined the company in 1950, is well-known in the metal-finishing industry. A member of the A. E. S. Cleveland Branch, he was general chairman of the National Convention



Joseph P. Branciaroli



Alexander E. Teyral

and Fourth Industrial Finishing Exposition in Cleveland last year. A past member of the Dayton Branch AES, and a charter member, past president and treasurer of the Columbus Branch, Combs now represents the Society on the American Standards Association Sectional Committee B-73, Centrifugal Pumps for Chemical Industry Use. He is a graduate of Ohio State University.

Prior to joining the company in 1952, Branciaroli was associated for two years with the U. S. Bureau of Mines, working in pilot-plant operations in coal gasification. Previously, he had been located at the Wright Air Development Center, where he was concerned with metal-finishing research and development. A member of AES, Cleveland Branch, and Alpha Phi Delta, Branciaroli holds a B. S. degree in chemical engineering from West Virginia University. He is a veteran of both World War II and the



J. Edwin Bride

Korean campaign. During World War II, he served with the Army as an infantryman, and for a year and a half as a first lieutenant in the Air Force during the Korean venture.

Smith, who joined the company following graduation from Kent State University in 1952 with a B. S. degree in chemistry, is a member of the American Chemical Society and the Cleveland Branch of the AES.

Teyral brings to his new assignment as project engineer 10 years' experience in development and technical service work in chromium chemicals. He was associated with the Development Department at the Research Center in Painesville from August, 1945 to October, 1953, and since then has concentrated on technical service

of chromium chemicals and their applications in various industries.

Bride comes to the company with a broad background in plating and electropolishing fields. For the past eight years, he has been connected with the Electrochemical Research Division of Battelle Memorial Institute, where he was closely associated with research on trivalent chromium alloy plating baths. He is co-author of several patents on this work.

From June, 1942 to October, 1945, Bride was assistant to the supervisor of the Metallurgical Materials Review Division, Wright Aeronautical Corp., Lockland Plant. A registered Professional Engineer in Ohio since 1946 and past president of the AES, Colum-



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because Cowles NS Soak Cleaner has extra soil capacity. Cowles NS Soak Cleaner gives you more emulsifying action—more power to hold loosened soil in suspension long after ordinary soak cleaners have broken down.

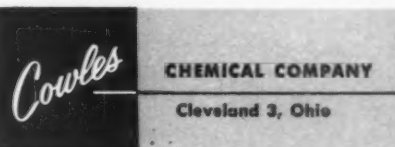
No scum on the cleaning tank to foul cleaned metal coming out. Clean it with Cowles NS Soak Cleaner and it stays clean. Your tanks stay clean, too. No sludge build-up.

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See Cowles' other advertisements on pages 87 and 95.



Robert C. Smith

bus Branch, he is a metallurgical graduate of Montana School of Mines, where he carried out work on beneficiation of low-grade chromite ores.

Veteran Oakite Representatives Attend First Anniversary Conference

Seventeen Oakite technical service representatives from as far west as Portland, Oregon met in New York

City recently for a five-day Anniversary Conference. The program was the first of three planned this year to enable field men to pool their experience, work side by side with laboratory chemists, and become thoroughly familiar with new products being made available to industry.

The service experience of the men, called in on their major anniversaries with the company, averages 12 years. Top man of the group was C. A. Peterson, of Los Angeles, with 35 years as an Oakite representative.

Similar conferences are planned for June and September, in which other representatives selected from the company's 218-man field organization will take part. The conferences are planned so that periodically each field representative will participate in intensive refresher training, designed to make his services even more valuable to the industry he serves.

Burnham, Tardiff Appointed to H-VW-M Sales Positions in Midwest

Hanson-Van Winkle - Munning Co. has announced the appointment of M. A. Tardiff and P. C. Burnham to key



M. A. Tardiff

sales posts in the company's midwest sales organization.

Tardiff is now responsible for general equipment sales for the J. C. Miller Division, with headquarters in Grand Rapids. Burnham is appointed conveyor sales engineer for J. C. Miller Division territory, the states of Ohio, Kentucky, Tennessee, Mississippi, and when needed, the Detroit area.

Tardiff has had extensive experi-

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P. C. Burnham

ence in the plating field. Prior to joining H-VW-M he was a partner in Vern Bush Co., a steel erection company, for 2½ years. Before that he was head plating chemist at Keeler Brass, Grand Rapids, for eight years. His previous experience includes 15 months at Winters & Crampton Corp., Grandville, Mich., in charge of the analytical plating laboratory; and 6 months in the chemical laboratory of Sealed Power Corp., in Muskegon, Mich.

Mr. Tardiff graduated from Hope College, Holland, Mich., in 1942, receiving an AB degree with majors in Chemistry and Mathematics. He has resided in Grand Rapids since 1949.

Mr. Burnham has been associated with H-VW-M since its merger with the J. C. Miller Co. in 1954. He had been with Miller since 1948, where he was metal finishing engineer. In this capacity he acquired considerable experience with automatic plating equipment, both from the engineering and sales standpoint.

Burnham is a veteran of World War II and spent 41 months overseas with the 32nd "Red Arrow" Infantry Division. Upon his return from service he attended Grand Rapids Junior College. He is an active member of the Grand Rapids Branch A. E. S., serving as vice president in 1954-55 and elected president in 1955. He is a native of Grand Rapids, where he now resides.

Blakeslee Appoints Two Sales Engineers

G. S. Blakeslee & Co. announces the appointment of *Harry J. Beierwaltes*



Harry J. Beierwaltes

and *Jack Fryer*, both as sales engineers.

Mr. Beierwaltes, who has had over ten years experience in the metal cleaning field, will cover an area consisting of western Michigan and the northern section of Illinois.

Mr. Fryer, who also has ten years experience in the metal cleaning field, will cover the entire state of Connecticut, as well as the western part of



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Soft amorphous type MICRO-SILICA

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OIL ABSORPTION (G & C)	36.4 to 40.3 LBS.
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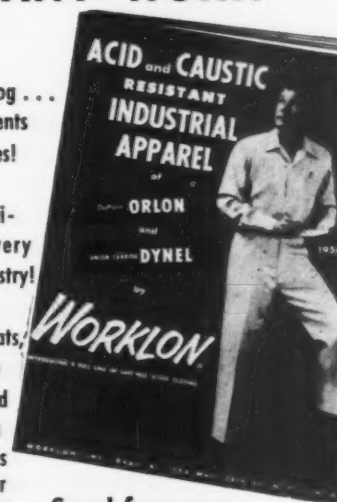
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Jack Fryer

Massachusetts including Springfield and Holyoke.

Meaker Appoints Conversion Chemical

The Meaker Co., Chicago manufacturer of mechanical equipment for electroplating and galvanizing, announces the appointment of the *Conversion Chemical Corp.*, 98 East Main St., Rockville, Conn., as exclusive sales

representative of the firm's products in the New England territory.

Dobeckmun Granted License by National Research

The *Dobeckmun Co.*, Cleveland, Ohio, has been licensed to conduct operations under patents owned by *National Research Corp.* relating to continuous vacuum metallizing. The processes made available to Dobeckmun are the result of work by National Research, carried out over a period of many years, directed towards the development of techniques and equipment for the continuous metallizing of plastics, paper, textiles, and other materials with a variety of metals, including copper, zinc, and aluminum.

18 Million Pounds of Nickel Released to Industry

The *Office of Defense Mobilization*, on March 21st, authorized the diversion to industry in the second quarter of 1956 of 18 million pounds of nickel from scheduled shipments to the Government during that period.

A major portion to be diverted will be premium priced ferronickel and nickel ingot.

In addition to the 18 million pounds, customary sales to industry of 500,000 pounds a month of nickel oxide from Nicaro production will be continued. This amount, regularly sold to industry each month since February 1954 will bring to 19.5 million pounds the total nickel being made available from Government sources during the second quarter.

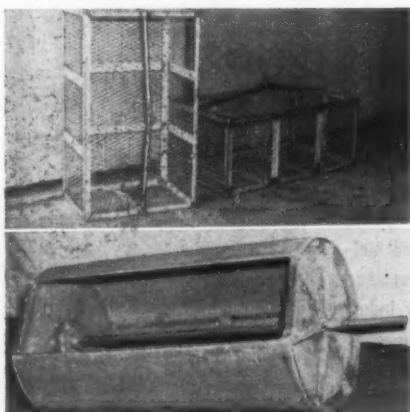
Stauffer to Build Sulfuric Acid Plant

Stauffer Chemical Co. has announced plans to build a new sulfuric acid plant, which will cost approximately two million dollars at Dominquez, Cal. Construction will begin within a month, with full scale production scheduled early in 1957.

The company has, at present, three sulfuric plants in California—at Richmond, Vernon and Dominquez.

International Nickel Company Appoints A. P. Gagnebin

The appointments of *Albert P. Gagnebin* as manager and *Harold Larsen* as assistant manager of the Nickel Sales Dept. of *The International Nickel Co., Inc.*, were announced recently.



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Material handling and processing equipment, fabricated to your specifications by STORTS, keeps your costs low by staying on the job. STORTS full-strength welding procedures eliminate maintenance and replacement expense. Make STORTS your source for equipment that is accurate in dimension and welded to last.



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CADMIUM DROSSES

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NICKEL ALLOYS

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Mr. Gagnebin succeeds *Ransom Cooper, Jr.*, who is retiring after 33 years' service.

Mr. Gagnebin became assistant manager of the Department in January, 1955. Prior to this appointment, he was in charge of the Ductile Iron Section of Development and Research Division. He became a member of the section in 1949 and was actively concerned with industrial development of the company's ductile iron, of which he was co-inventor.

Mr. Gagnebin's association with company dates from 1930, when he spent the summer working at its Huntington Works in West Virginia. After graduate studies in metallurgy, he joined the research laboratory at Bayonne, N. J., in 1932 and devoted himself to research on ferrous metals.

Mr. Larsen has been with the firm for 30 years, serving in various capacities in the Nickel Sales Department. In 1953, he was named assistant to the manager of the department, prior to which he had been assistant section head of the Distributors' Sales Section. For a time, he was on the staff of the National Production Authority in Washington as Chief of the

Nickel Section of the Iron and Steel Division. He is a member of the American Foundrymen's Society and the American Society for Metals.

Mr. Gagnebin obtained his Bachelor of Science degree (mechanical engineering) from Yale University in 1930 and his Master of Science degree (metallurgy) in 1932.

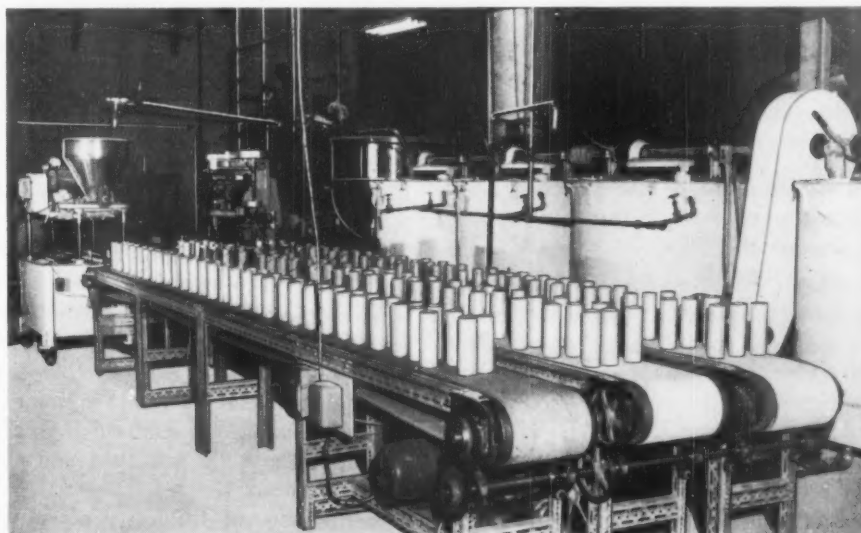
McAleer Mfg. Corp. Installs New Equipment

To achieve greater uniformity of

product and to lower costs in processing, *McAleer Mfg. Corp.*, Detroit recently installed new production and packaging equipment.

The new installation eliminates irregularity of formula, assures precision from batch to batch, since ingredients are mechanically metered; overheating is eliminated, proper cooling is automatic.

The firm's own engineers designed and supervised construction, also creating a central control panel. This



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No added investment. Just order Thinker Boys when you buy racks. Instead of ceilings cluttered with no longer needed racks, you'll soon have a supply of Thinker Boy Parts—be able to assemble coated racks of your own design in a matter of minutes. Ask your BELKE Service Engineer or write for details.

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EVERYTHING FOR PLATING PLANTS

panel operates the manufacturing processes and the packaging sequences. The photo shows a stream of grease stick packages coming off the belts.

Conversion Chemical Named as Chandeysson Distributor

Appointment of *Conversion Chemical Corp.*, 98 E. Main St., Rockville, Conn., as its distributor has been announced by *Chandeysson Electric Co.* of St. Louis. Conversion Chemical will handle the complete Chandeysson line of low-voltage motor generators.

Kenneth P. Bellinger, president of the distributorship, is well known throughout New England as a man well qualified on plating equipment and motor generator set power supply.

McGuire Named Manager of Equipment Installation Sales at H-VW-M

Hugh V. McGuire has been appointed manager of equipment installation sales by *Hanson-Van Winkle-Munning Co.*, manufacturer of electroplating and polishing equipment and supplies.

Mr. McGuire has been in charge of all sales engineering relating to engineering and installation activities, and



Hugh V. McGuire

his appointment is in line with the company's new policy for the consolidation and expansion of these activities.

Mr. McGuire has been with the firm for 15 years, during which period he spent time gaining extensive experience in the metal finishing equipment field. He has also specialized in plant layout, the graphic arts field and export activities.

A graduate of Rutgers University,

Mr. McGuire has undertaken subsequent studies relating to his work in the engineering and installation of metal finishing equipment.

Manufacturers' Literature

Solvent Detergent for Power Washers

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

A recently published folder describes the properties of Oakite Composition No. 98, a solvent detergent which is said to clean and protect against rust at the same time.

The folder suggests uses of this material lists advantages, and gives recommended solution concentrations and temperatures for single and two-stage washing machines.

Demineralizer and Filter Washer

Graver Water Conditioning Co., Dept. MF, 216 West 14th St., New York 11, N. Y.

Technical Reprint T-139 discusses

McKeon's Zinc-Brite

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ZINC SOLUTION PURIFIER

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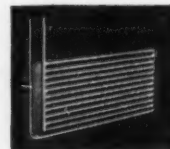
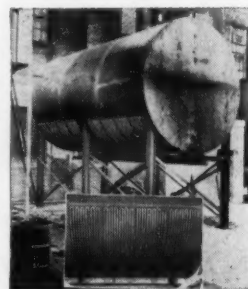
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the development of the Sub-Surface Washer, used in demineralizers, zeolite softeners and filters.

This technical paper presents the causes of fouling and the problems encountered with actual installations in a variety of industries. The steps leading to the development of the washer are presented and a cutaway drawing showing this unit is included. Other descriptive material includes flow sheets and a diagrammatic sketch of pilot unit observations.

Germanium Rectifiers

General Electric Co., Dept. MF, Schenectady 5, N. Y.

Bulletin 1204 gives general information on industrial uses of germanium rectifiers, including characteristics, construction, advantages, and design and application considerations.

Centrifugal Pumps

The Deming Company, Dept. MF, Salem, O.

A new bulletin (4011-A) describes the complete line of redesigned and resized end suction centrifugal pumps

produced by the above company. The bulletin includes Figs. 4011 and 4021, representing different power ends, to which numerous sizes of liquid ends can be attached. Performance tables and curves in the bulletin list characteristics of all possible combinations.

Finishing Compounds

The Swift Industrial Chem. Co., Dept. MF, Canton, Conn.

Technical bulletins on heat treating, plating, finishing and allied compounds are now available bound in an attractive, permanent cover from the above manufacturer.

Each durable booklet contains data sheets and information on heat treating salts, black oxide compounds, metal cleaning compounds, rust resisting oils, quenching oils, and other products that form the firm's complete line of industrial chemicals and equipment.

Drum Handling Equipment

Morse Mfg. Co., Dept. MF, 727 Manlius St., East Syracuse 1, N. Y.

A four-page folder describes the

firm's complete line of manual and motorized drum handling equipment. In addition to the company's drum cradles, lifting hooks, hand trucks and tipping levers, the new folder describes a portable drum rotator and the "Rock-a-Drum."

Precious Metals and Solutions

Sigmund Cohn Corp., Dept. MF, 121 South Columbus Ave., Mount Vernon, N. Y.

A new 24-page catalog, listing products and specifications, has just been released by the above manufacturer. Some of the subjects covered are commercial forms of Platinum, and plating solutions (Rhodium and Gold). Many helpful tabulations for handy reference appear throughout the catalog, including: Table for Weight per Foot Platinum Wire, Properties of Some of the Common Metals, Brown and Sharp Gauge Sizes, etc.

Protective Coatings

Nukem Products Corp., Dept. MF, 111 Colgate Ave., Buffalo 20, N. Y.

An eight-page, illustrated booklet

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features Nukemite 24, 33 and 40 protective coatings. Information is given on the features and usage of each, as well as properties and application charts. *

Additional information, or copies of the booklet, may be had by writing to the above manufacturer.

Tank Rheostats

Columbia Electric Mfg. Co., Dept. MF, 4519 Hamilton Ave., Cleveland 14, O.

A recently issued catalog bulletin, Section 500 (Form TR-10256) covers the above manufacturer's cast grid type tank rheostats which are available in ampere ratings from 15 to 5,000 amperes, 1 to 6 volt drop, as specified.

Rinsing Hints

Joseph B. Kushner Electroplating School, Dept. MF, 115 Broad St., Stroudsburg, Pa.

"Good Rinsing for Good Plating" is the title of this four-page illustrated booklet which gives the seven basic ways for improving rinsing. It shows how rinse water impurities build up in

plating tanks, gives a method for calculating water flow rates and saving on water, methods for agitating the rinse water, the effect of water temperature on rinsing and the various other factors that control the quality of the rinsing operation. The booklet is offered free of charge, while the supply lasts, to everyone who requests a copy.

Electric Heaters and Heating Devices

General Electric Co., Dept. MF, Schenectady 5, N. Y.

Electric heaters and heating devices. Bulletin GEC-1005G, 60 pages, contains application index, calculating data, specifications, operating information, and list prices of standard G-E heaters and heating devices. Included are immersion, strip, cartridge, tubular, fin, and railroad switch heaters; unit heaters, soldering irons, glue pots, soft-metal melting pots, oven equipment, and control. Process and application index shows methods of heating and type of heater recommended for various heating processes.

Precious Metal Salts and Solutions

J. Bishop & Co. Platinum Works, Dept. MF, Malvern, Pa.

The above firm has issued a list of chemicals and precious metal catalysts, used in analytical research, as research tools and for industrial applications.

Solutions for the preparation of plating baths are given, together with their formulas and approximate metal percentage.

This list, as well as information on other compounds, is available on request.

Plastisol Coating Equipment

Quelcor, Inc., Dept. MF, Front and Broomall Sts., Chester, Pa.

Data Sheet No. 85 describes and pictures a new laboratory-type unit for coating small parts and assemblies with polyvinyl chloride plastisols.

The unit is equipped with dipping materials, primer, curing unit, welding and test apparatus.

Circular describes the equipment in detail as well as providing suggestions concerning its use with a variety of different coating jobs.

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The Hartford Steel Ball Co., Inc., 13 Jefferson Ave., W. Hartford 6, Conn.

Acid Proof Materials of Construction

The Atlas Mineral Prods. Co., Dept. MF, Mertztown, Pa.

Bulletin CC No.3 is a new 16-page bulletin giving basic data on the complete line of corrosion proof construction materials manufactured and installed by the company. This bulletin contains chemical and physical data, estimating data and descriptions of products used for acid proof installations.

Included in the bulletin are sections on corrosion proof cements, tank linings, protective coatings, rigid plastic fabrications and rigid plastic pipe, plus a chart showing their resistance to various chemicals.

Rubber Lining Tanks, Valves, Fittings

Protective Coatings Div., Metalweld, Inc., Dept. MF, Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.

An illustrated, two-color, 8-page bulletin describes the advantages and application of rubber lining to steel

tanks, drums, pipes, valves, fittings and pumps. Included in the bulletin are important tables giving the resistance characteristics of the rubber lining to inorganic acids, salts and alkalis, organic materials and a wide group of miscellaneous materials. Details on the chemical, abrasive and temperature resistant qualities of rubber linings and the different types of linings available are also given. Plant facilities for cementing, lining, and vulcanizing all types and sizes of equipment are illustrated, and the bonding process which joins rubber and steel together with a bond strength of over 500 psi, is described.

Ultrasonic Systems and Applications

Acoustica Associates, Inc., Dept. MF, Glenwood Landing, L. I., N. Y.

The benefits which may be derived from ultrasonic techniques in cleaning and degreasing, electroplating, drilling and grinding operations are reported in a new Bulletin, MW-103, just published.

Entitled, "Ultrasonic Barrier Broken

by Low Cost Power Supply," the 4-page, 2-color bulletin also describes various ultrasonic power supplies, transducers, and systems offered by the above manufacturer for small and large scale production requirements.

NEW BOOKS

1956 Finishing Handbook and Directory

Edited by I. S. Hallows. Published by Sawell Publications Ltd., 4 Ludgate Circus, London, E.C.4, England. 1956. 489 pages including index. Price: 45 shillings, postpaid.

The price for the sixth edition of this well known book includes twelve monthly issues of the magazine *Product Finishing*. A number of changes have been made in the finishing sections this year. New material comprises cures for faults in plating baths, treatment of plating wastes, which is covered in great detail, British finish-

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ing specifications and books on finishing subjects. In addition, the sections on paint testing, finishing equipment, and processes have been extensively revised.

As usual, the yearly revised directory of suppliers, trade names, job shops, etc., will be of interest mainly to British readers, except for a listing of British representatives of American companies, which is new. Although much of the information is similar to that found in American handbooks, the volume will be of interest for the comparison of methods employed in the two nations.

ASTM Standards: Part 2

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1955. 1,516 pages. Price: \$11.00.

Part 2—Non-Ferrous Metals covers copper, lead, aluminum, magnesium, their alloys, and widely used test procedures. 156 of the standards are new or have been revised since 1952, of a total of 270.

The groups covered in this volume of interest to the metal finisher in-

clude galvanized iron and steel wire, electrodeposited coatings, and general testing methods for anodic coatings, corrosion, and thickness of deposits.

OBITUARIES

ROBERT P. MILLIGAN

Robert P. Milligan, formerly vice-president of the George A. Stutz Mfg. Co., Chicago, Ill., died at Veterans Hospital Friday, March 9, 1956.

THOMAS F. SLATTERY

Thomas F. Slattery died on February 25 at Paradox Lake, N. Y., where he had lived since his retirement in 1953 due to poor health.

Born in 1886, he was associated with electro-forming and electro-deposition of metals since his early youth. Following World War I, during which he served with the Army in the Chemical Warfare Service, he joined the Bureau of Standards in Washington, D. C., the electro-chemi-



cal section. At the time of his retirement he was assistant director of the Bureau of Engraving and Printing.

Loved and admired by his many friends, Tom Slattery was active for many years in the Baltimore-Washington Branch of the American Electroplaters' Society, and was president of the Society in 1935-36.



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HAVERHILL, MASSACHUSETTS

News from California

By Fred A. Herr



Los Angeles Plating Co. has plans awaiting municipal zoning board approval that call for a 10,000 square foot addition to its main plating plant at 6921 Avalon Blvd.

Contemplated is a new 70 x 140 foot structure costing approximately \$100,000 which is to be equipped with some \$35,000 worth of new finishing equipment. The new facilities will supplement present tanks, provide for several additional finishing operations, and equip a larger barrel plating department.

Upon completion of the new building, which will bring the total floor space on Avalon Blvd., to some 25,000 square feet, the anodizing and other facilities now housed in Shop No. 2 at 6901 S. Central Ave., will be

concentrated in the Avalon Blvd. premises.

Simultaneously, according to *Howard C. Hiland*, vice-president and general manager, the Avalon Blvd. plant's plating lines are to be realigned and streamlined in order to expedite operations, and make room for the new tanks and a larger barrel plating division.

The firm was founded in 1939 with one cadmium tank and two employees, who were the owner, *Laurence Rotollo*, and his wife *Dorothy*. Since moving to the Avalon Blvd. location in 1942, the firm has expanded to equip itself with facilities for processing cadmium, or zinc, both barrel and still, brass, steel, aluminum, copper, and nickel, plus a special anodizing section. The firm claims to be equipped to perform practically every type of plating known to the industry, and also buffing, polishing, vapor blasting, baking, centerless grinding, and solid film lubrication process.

Rotollo is president; Hiland, who started as a shop helper in 1941, vice-president and general manager; and *John V. George*, secretary-treasurer.

Dan Gentile, metallizing engineer for M&A Steel Sales & Service, Inc., Puente, Calif., reports that his firm is installing a set-up for plating copper and stainless steel wire direct.

Equipment being installed includes a 650 gallon acid copper tank, an acid dip tank, and cleaning tanks. This equipment supplements a pickling set-up installed earlier this year for pickling alloy wire in all aircraft qualities. Three sulphuric acid tanks (1 of 3,500 and 2 of 1,500 gals. each) comprise the major units for treating light drawn wire.

Gentile pointed out that, heretofore, most drawing of wire for Southern California users had to be done "back east." With its new equipment, M&A is now the only firm on the West Coast in position to draw wire from the thinnest piano wire to 1 inch in diameter.

A welcome visitor to Southern California in April was genial *Edwin C. Rinker*, vice-president and technical director of Sel-Rex Precious Metals, Inc., Belleville, N. J. He was accompanied by Mrs. Rinker. Mr. Rinker re-

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ferred to his visit as "... business combined with a modicum of pleasure." The business phases pertained to consultations with members of the West Coast plating industry and allied industries in which the firm's products are employed, on ways and means to provide West Coast clients with the best possible service. Mr. Rinker attended the April 11 meeting of Los Angeles Branch, A.E.S., where he renewed acquaintance with many a transplanted "down easterner."

Mefford Chemical Co. moved April 16 from 1026 Santa Fe Ave., Los Angeles, to new quarters at 5353 Jillson St. in the east-side industrial district of the same city.

According to a handsomely printed announcement which *George Hetz*, assistant sales manager and director of the plating supply division, supplied to this columnist, the firm's new one story building will provide this subsidiary of McKesson & Robbins, Inc., with 80,000 square feet of warehouse space and some 7,000 square feet for office and administration facilities. Modern facilities in the form of an explosive room with blow-out walls and

an inflammable products room are included in the new plant. An open house, at which Southern California platers will be given an opportunity to inspect the new building, is planned for some time in May.

Installation of plating lines for finishing automobile bumpers in the new plant of Rheem Automotive Co. at Fullerton, Calif., was nearing completion in mid-April.

The plating facilities include a cleaning line, two nickel lines and a chromium line. Production control on the line will be so precise that there will be uninterrupted movement of the bumpers from one line to the next, and through each solution in two-minute cycles, or at the rate of about 30 completed racks per hour.

Installation has also been completed on heat exchangers, pumps and filters. Two 220 h.p. boilers have been set up at the end of the plating line to provide the necessary steam to maintain temperatures of plating liquids and for other manufacturing purposes.

San Francisco's Golden Gate Chapter of the *American Society for Metals*

in April sponsored a spring lecture series on "Applications and Limitations of Metals in Service." The series consisted of four Wednesday night lectures, each dealing with a field of metals application of specific interest to local industry, including chemical, petroleum, electronics, aircraft, and atomic energy.

Ted Goodman, formerly owner of Santa Monica Plating Co. and Acme Metal Finishing Co., has sub-leased floor space in the shop of Planet Plating Co., 7902 Woodley Ave., Van Nuys, Calif., which he has equipped for anodizing aircraft, electronics and guided missile parts. He operates under the name of Planet Anodizing Co. He is equipped, he reports, to do color anodizing, sulphuric acid and chromic acid anodizing, and plans to install facilities for hard anodizing, processes for magnesium work, and other aircraft finishes.

Since selling Santa Monica Plating Co. to *Wesley Jay* about a year ago, Goodman served as metal finishing and quality control supervisor for Summers Gyroscope Co., Santa Monica, Calif.



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Ten sessions—four of them of the dual variety and one triple—promise everyone a full program of education at the Hotel Statler.

According to Dr. Abner Brenner of the National Bureau of Standards, chairman of convention educational committee, the following papers are tentatively scheduled to be presented at the times and dates shown:

Monday, June 18, 1956

2:00 p.m.

Session A. PRESIDENTIAL ROOM

Novel Applications of Plating

Chairman: Dr. E. R. Bowerman, Sylvania Electric Products, Inc.

1. Some Recent Developments in Selective Localized Plating for Engineering Purposes. By *Marv Rubinstein*, Metal Finishing Consultant.
2. Investigation and Evaluation of Plating Processes and Plate Combinations for Use on Etched Circuitry. By *E. H. Babcock*, *R. K. Stephens* and *R. C. Grinsinger*, Convair.
3. Overlay Plating of Steel Back Aluminum Lined Sleeve Bearings. By *A. H. Beebe*, *B. F. Rothschild* and *G. J. LaBrasse*, Federal Mogul Research and Development.
4. The Protection of Molybdenum Against High Temperature Oxidation. By *Julius J. Harwood*, Office of Naval Research, Department of the Navy.

Session B. CONGRESSIONAL ROOM

Thickness and Distribution of Coatings

Chairman: Dr. R. B. Saltonstall, The Udylyte Corporation.

1. Gaging Thin Nickel Coatings by

X-Ray Fluorescence. By *W. W. Sellers* and *Kenneth Carroll*, Research Laboratory, International Nickel Company, Inc.

2. Measurement of the Thickness of Metallic Coatings by X-Ray. By *Earl J. Serfass* and *Fred Achey*, Lehigh University.
3. Current Distribution of Microfiles. By *D. Gardner Foulke* and *Otto Kardos*, Hanson-Van Winkle-Munning Company.
4. Leveling — Definition, Measurement and Understanding. By *J. D. Thomas*, General Motors Corporation.

Tuesday, June 19, 1956

9:00 a.m.

Session A. PRESIDENTIAL ROOM

Physical and Mechanical Properties of Deposits

Chairman: Mr. J. Teres, Wright Air Development Center.

1. Properties of Electro-deposits at Elevated Temperatures. By *W. H. Safranek* and *G. R. Schaer*, Battelle Memorial Institute.
2. Limitation of Plated Nickel in Jet Engine Design. By *R. W. Moeller* and *W. A. Snell*, Pratt and Whitney Aircraft.
3. Some Characteristics of Electroformed Iron Deposits. By *A. M. Max*, Radio Corporation of America, *G. R. Van Houten*, P. R. Mallory and Company.
4. A Study of the Effect of Several Organic Addition Agents on the Hardness and Residual Stress in Nickel Deposits. By *I. L. Newell*, The Henry Souther Engineering Company.

Session B. CONGRESSIONAL ROOM

Analysis and Control

Chairman: Dr. Earl J. Serfass, Lehigh University.

1. Spectrochemical Determination of Nickel in Bright Cadmium Plating

Solution. By *Morton Levy* and *Henry Friedenberg*, Crobaugh Laboratories.

2. Complete Polarographic Analysis of Cyanide Zinc Plating Baths. By *Thomas H. Collard, Jr.* and *David K. H. Liu*, Friedrich Refrigerators, Inc.
3. The Polarographic Determination of Cadmium and Cyanide in Alkaline Cadmium Plating Solutions. By *G. T. Forsyth*, Udylyte Research Corporation.
4. Hyperbolic Electroplating Cell. By *R. F. Walton*, Radio Corporation of America, and *Dr. R. Gilmont*, Manostat Corporation.

3:00 p.m.

Session A. PRESIDENTIAL ROOM

Equipment and Engineering

Chairman: Mr. L. F. Scott, United Chromium Corporation.

1. Coated Abrasive Belts Speed Metal Working Production (motion picture in color). By *E. E. Oathout*, Behr-Manning Coated Abrasives Division of Norton Company.
2. Filter Media. By *M. L. Whitehurst*, *Elmer Lundberg*, *Quentin O. Schockley*, and *John M. Hood*, Indianapolis Branch of American Electroplaters' Society.
3. Tank Linings. By *Kenneth G. LeFevre*, Metalweld, Inc.
4. Plating Room Tank Ventilation Equipment. By *F. W. Arndt*, Heil Process Equipment Corporation.

Session B. CONGRESSIONAL ROOM

Protective Value and Related Properties of Coatings

Chairman: Mr. C. H. Sample, International Nickel Company.

1. Radiographic Detection of Pores in Nickel Coatings. By *Fielding Ogburn* and *Margaret Hilkert*, National Bureau of Standards.
2. The Permeation of Gases Through Electrolytic Nickel Deposits as Affected by Accelerated Corrosion. By *J. Martin Tobin* and *D. Gardner Foulke*, Hanson-Van Winkle-Munning Company.
3. The Effect of Impurities and Purification of Electroplating Solution. I. Nickel Solutions.—*D. T. Ewing*, Mich. State; (9) The Effects And Removal of Aluminum. *D. T. Ewing*, Michigan State U. and *W. O. Dow, Jr.*, Sunbeam Corporation; (10) The Effects of Man-

ganese. By *A. J. Smith*, Michigan State University and *R. J. Rowe*, Dow Chemical Company.

4. Progress Report on Accelerated Corrosion Tests for the Performance of Plated Coatings (AES Project 15). By *W. L. Pinner*, Houdaille-Hershey Corporation.

Wednesday, June 20, 1956

9:00 a.m.

Session A. PRESIDENTIAL ROOM

Alloy Plating

Chairman: Dr. W. A. Wesley, International Nickel Company.

1. Electrodeposition of Porous Nickel-Cadmium Alloy. By *L. D. McGraw*, *J. P. Spenard* and *C. L. Faust*, Battelle Memorial Institute.
2. Gold-Silver Alloy Plating. By *A. G. Cafferty* and *R. E. Harr*, Western Electric Company.
3. Nickel-Iron Alloy Electro-deposits for Magnetic Shielding. By *V. P. McConnell*, *I. W. Wolf*, Electronics Division, General Electric Company.
4. Improved Techniques for Electroless Nickel Plating on Non-conductors. By *Harold Narcus*, Electro-Chemical Industries, Inc.

Session B. CONGRESSIONAL ROOM

Three Different Coating Types. A Trilogy

Chairman: Mr. G. A. Lux, Oakite Products, Inc.

1. Study of Phosphate Treatments for Metals. By *Lloyd Gilbert*, Rock Island Arsenal.
2. Organic Finishes on Plated Products. By *Gene L. Leithauser*, Research Staff, General Motors Corporation.
3. Electrodeposition of Antimony. By *A. H. DuRose*, Harshaw Chemical Company.
4. Acceptance Sampling by Variables. A Tool for Decision. By *Roger H. Moore*, Los Alamos Scientific Laboratory.

Thursday, June 21, 1956

9:00 a.m.

Session A. PRESIDENTIAL ROOM

Chromium Plating

Chairman: Mr. Arthur Logozzo, Nutmeg Chrome Corporation.

1. Chromium Plating on Gun Bores. By *V. A. Lamb* and *J. P. Young*, National Bureau of Standards.

2. Hard Chrome Plating of Titanium Alloys. By *L. Missel*, Lockheed Aircraft Corporation.
3. The Adhesion of Electroplated Coatings to Titanium. By *Connie Stanley* and *Abner Brenner*, National Bureau of Standards.
4. Electroplating on Unusual Alloys. By *Charles Levy*, Watertown Arsenal.

Session B. CONGRESSIONAL ROOM

Basic Studies of Baths and Deposits

Chairman: Dr. William Blum.

1. Electrodeposition of Aluminum from Aluminum Chloride—Amine Ether Electrolytes. By *Nelson F. Murphy* and *Arthur C. Doumas*, Virginia Polytechnic Institute, Blacksburg, Virginia.
2. The Growth and Properties of Metal Whiskers. By *S. M. Arnold*, Bell Telephone Laboratories, Inc.
3. Study of Adhesion by the High Speed Rotor Techniques. By *J. W. Beams*, Department of Physics, Rouss Physical Laboratory, University of Virginia.
4. Dissolved Gases in Plating Baths. By *W. M. Tucker* and *F. O. Beuckman*, Eastman Kodak Company.

CHILDREN'S PROGRAM

IS ADDED FEATURE

FOR CONVENTION

Chairman *Arthur Pierdon* announces that for the first time at any AES Convention a special program for children has been arranged. This will be a novel feature of the Washington Convention and a large number is expected. For the assistance of parents in making their plans, the youngsters' program follows:

Sunday, June 17, 1956

3:00 p.m.

Get Together Party

Hotel Statler—Federal & South American Rooms—

Admission by ticket.

Monday, June 18, 1956

11:00 a.m. to 4:00 p.m.

SIGHTSEEING

Bus: Hotel Statler—16th St. Entrance
National Zoological Park

Lunch

Smithsonian Institute & Museum of Natural History

Use ticket in book.

9:00 p.m.

Metal Finishing Suppliers Association
Open House

Admission by ticket.

Tuesday, June 19, 1956

10:00 a.m. to 4:00 p.m.

SIGHTSEEING

Bus: Hotel Statler—16th St. Entrance
Washington Monument

U. S. Capitol (Guided Tour)

Federal Bureau of Investigation

Trip through Potomac Park

Use ticket in book.

Wednesday, June 20, 1956

1:00 p.m.

Trip to Mt. Vernon

Bus: Hotel Statler—16th St. Entrance
See Changing of the Guard at the Tomb of the Unknown Soldier

Ride Through Old Alexandria

Visit Mt. Vernon

Enjoy a boat ride on historic Potomac River

Use tickets as marked.

9:30 p.m.

Floor Show

Admission by ticket.

Thursday, June 21, 1956

10:00 a.m. to 4:00 p.m.

SIGHTSEEING

Bus: Hotel Statler—16th St. Entrance
White House

Bureau of Printing & Engraving

Lincoln Memorial

Lunch

Washington National Airport

Use ticket in book.

Baltimore-Washington Branch

The March meeting of the Baltimore-Washington Branch was held in the Coach Room of the Park Plaza Hotel in Baltimore on Monday, March 12, 1956. The guest list included national president *Clyde Kelly* and executive secretary *P. Peter Kovais*. Festivities began with cocktails, followed by a broiled chicken Dinner. Dinner finished, president *Metzger* called the meeting to order at 9:20 P.M. The first order of business was to stand for a minute in silent tribute to our dear friend and member *Tom Slattery*, who died on February 25, 1956.

Fielding Ogburn and *Ray Stricklin* were appointed as a committee to nominate a slate of branch officers to be presented at the May meeting when the election of officers will take place.

The meeting was then turned over to *Ken Huston* who proceeded to induct Mr. Kelly, the guest of honor, into the Order of Past Presidents (formerly the Order of the Pot).

Following his induction, Mr. Kelly showed color slides of the national offices and personnel, and explained

how the business of the national offices was conducted.

The speaker of the evening, *Dr. E. R. Powerman* of Sylvania Electric Products Co. was introduced by president *Metzger*.

Dr. Bowerman, who is chairman of the Committee of A.E.S. Research Project No. 16, gave a brief outline on the status of that project before speaking on printed wiring.

Detroit Branch

Two hundred members and guests were present at Ladies' Night, the March meeting of the Detroit Branch, which was held at the Statler Hotel on March 2nd.

The meeting was started with a movie taken while on flight over the United States. *Lee Morse*, president, officially opened the meeting at 9 p.m. at which time he announced that *Dave Hardesty*, of General Motors Research, would start a course in electroplating on March 10th. Classes will be held each Friday evening at 8 p.m. at various organizations throughout the city.

Wright Wilson reported that a profit

of \$769.00 was made at the Christmas party last December.

The speaker of the evening, *Joe Gurski*, of Ford Motor Co., was introduced by *Doug Thomas*. Mr. Gurski spoke on his recent trip to Europe and showed some very interesting colored slides. Some of the cities he visited were London, Paris, Cologne and Dusseldorf.

Patrick J. Driscoll

Indianapolis Branch

The March meeting and dinner was held at Brodey's Village Inn at 21st and Arlington Ave. on the 7th with forty-five members and guests present. Following introductions and reports of secretary and treasurer, reports were given on Tri-State meeting and our own Annual affair. *Roman Bender* reported that contributions were coming in nicely, *Frederick Anderson* reported that the program is all set for the educational session and *Edna Rohrabau* reported that favors for the ladies were chosen and ordered.

Concerning the history of the Indianapolis Branch, *Ed Bruck* is hunt-

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ing information of the charter meeting and who the charter members were. He has found several items of interest but desires much more.

A transfer of membership was accepted in a motion by *Bert Hawhee* and seconded by *Jack Vaughan*. This transfer is for *Robert Cook*, 407 N. Main St., Fortville, Ind. Two new members were voted into the Society in a motion by Mr. Bruck and seconded by Mr. Hawhee. They were *Robert J. Ferry*, 3422 E. 26th St., Indianapolis 18, Ind., and *Kenneth F. Blanck*, R. No. 1, Whiteland, Ind.

In a motion by *Lowell Fisher* and seconded by Mr. Hawhee, the secretary's expenses are to be paid to the Tri-State meeting. This motion was passed.

The Branch was honored and privileged when *Walter Pinner*, a former national president of A.E.S. was present and gave a message on Project No. 15. He gave the many tests tried out in the motor-car city of Detroit which numbered twenty in all. Each one was explained and we were told if that particular test is in effect. The project to date is valued at over one-hundred

thousand dollars but has cost the A.E.S. \$150.00 in all. Test parts have been put on over 200 taxicabs in Detroit and on two dozen privately owned cars. He stated that hours of compliance of the salt spray test shall be agreed upon by purchaser and user. Many slides were shown and the results certainly were visualized by the group. After the talk, many questions were asked by the group.

Edna Rohrabach
Secretary

Buffalo Branch

The Buffalo Branch set March 2, with President *A. A. Janie* presiding. Two lady visitors *Mrs. H. B. Campbell* and *Mrs. C. J. Wernlund* were introduced to the Buffalo Branch. *Boris Joffe* reported favorably on the advertising for the Empire Regional Meeting. *Ben Fortin* reported that all arrangements are now complete for the regional meeting. The ladies program will be a style show and tea.

President Janie appointed *Joe Ruff*, *Robert Guy* and *W. M. Fotheringham* as nominating committee to report at the April meeting.

Frank Rudolph, the librarian introduced the speaker of the evening *Barnet D. Ostrow*, general manager of *Lea-Ronal, Inc.* who spoke on "Bright High Speed Silver Plating" followed by a discussion period.

The April Meeting of the Buffalo Branch will be held April 6 at the Markeen Hotel. Election of officers will take place.

Eric G. Sampson, Jr.
Secretary

Los Angeles Branch

The annual election of Los Angeles Branch was held on the night of March 14 in Rodger Young Auditorium, Los Angeles, and resulted in the unanimous selection of a proposed slate of candidates submitted by a nominating committee composed of *Stuart Krentel*, *Earl Coffin* and *Al Sulzinger*.

The new president is *L. Truman Stoner* of Chief Products, Inc., who will take over the branch leadership from *Earl W. Arnold* of the L. H. Butcher Co., at installation services on the night of April 11.

George Magurean of Convair, Inc.,

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Pomona, Calif., was elected first vice-president; *Norman McEwan*, Virtue Bros., second vice-president; *Frank Virgil*, L. H. Butcher Co., secretary; *George Hetz*, Mefford Chemical Co., treasurer; and *Emmet Babcock*, who only a few months ago transferred from Indianapolis Branch to Los Angeles, when he joined the Convair finishing staff, was chosen librarian.

Earl Arnold (chairman), *Harvey Hunt* of Alert Supply Co., and *Tony Stabile*, Associated Plating, comprise the new board of managers. Babcock, *Marty Barsoom* of The Whittaker Co., and *Krentel* of Kelite, Inc., were named delegates to the national convention, with *Jack Bealle*, *Kenneth Johnson* and *Stabile* as alternates.

A dozen or more Los Angeles members indicated their intention of attending the Washington convention in order to lend their support to Los Angeles Branch's bid for the 1956 convention.

A sergeant-at-arms and chairmen of standing committees will be named by the incoming president at the April meeting.

Retiring vice-president Stoner, who directed the membership drive termi-

nated in March, announced that the prizes (merchandising certificates) would be awarded on April 11. Unofficially it appears that the drive resulted in bringing from 20 to 25 new members into the fold. Plans for pursuing a similar drive during the 1956-57 fiscal year are under consideration.

Accepted into membership at the March meeting were *P. E. Parham* of Whittaker Gyro, Inc., *William P. Thomas* of Crown Chemical & Engineering Co., *Flyd Cook* of L. H. Butcher Co., and *Martyn M. Yardley* of Chrome Nickel Co.

Members of the A.E.S. Branch were invited by Los Angeles Chapter of The Electrochemical Society to attend its April 5 meeting at which *Dr. R. M. Burns* of the Stanford Research Institute was to present a paper on "Electrochemical Corrosion in the Telephone Industry."

Chicago Branch

On Friday, March 9, Chicago Branch assembled at the Western Society of Engineers for their regular monthly meeting and Educational Session.

After the usual friendly get-together

during the cocktail hour and an excellent dinner, the group took up the important business of electing its officers for the coming year. There was a unanimous acceptance of the slate submitted by the nominating committee.

The officers chosen to direct the branch activities for the coming year were:

President — *Russel E. Harr.*

First Vice-President — *Ralph E. Pettit.*

Second Vice-President — *Charles R. Silhavy.*

Librarian — *R. Scott Modjeska.*

Secretary-Treasurer — *Paul Glab.*

BOARD OF MANAGERS:

Chairman — *S. P. Gary, Jr.*

Members — *Ed Stanek, Matt Dasinger.*

DELEGATES:

Russel E. Harr, Paul Glab and Clyde Kelly.

ALTERNATE DELEGATES:

H. A. Gilbertson, Joseph M. Andrus and Marion E. Lonfield.

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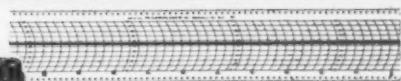
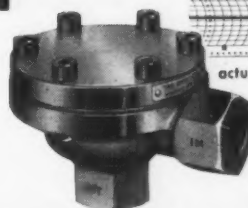
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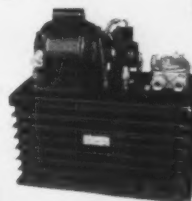
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the branch heard an excellent presentation by *C. J. Glasrud*, technical supervisor of the Honite Division, Minnesota Mining and Mfg. Co. on the subject of "Precision Barrel Finishing," as applied to abrasive finishing. Pointing out that barrel finishing is a cold abrasive process for the removal of metal, Mr. Glasrud followed through to cite applications for the process. His discussion covered the cleaning of castings, deburring, alkaline or acid cleaning and coloring.

The members present showed their appreciation and considerable interest in the subject by the many excellent questions which they asked.

Friends of and members of the branch will be pleased to learn that *Fran Lanz* is making a good recovery from his recent illness. After having recuperated in Florida he is once more on the active list at Northwestern Plating Works.

Jerome Kuderna,
Publicity Chairman

Los Angeles Branch

Los Angeles Branch held its 26th annual Educational Session and Dinner Dance at the Statler Hotel in Los Angeles, Calif., on Saturday, March 17, with 150 members and guests present at the technical meeting and a record breaking attendance of 670 at the grand ball and banquet in the evening. The program was divided into one four-hour technical session from 9 a.m. to 1 p.m., a noon-day luncheon, and the dinner-dance from 7 to midnight.

Librarian *Norman K. McKeon* presided over the technical session at which he introduced as the first speaker *Robert O. Johnson* of the engineering staff of Consolidated Vacuum Corp., Palo Alto, Calif. The subject of Mr. Johnson's discourse was "Vacuum Metallizing," in the course of which he outlined how platers could make

use of evaporated metal film, explained the technique, and illustrated, with slides, the three basic types of metallized applications.

The second speaker was *R. Scott Modjeska*, professor of chemistry at the Illinois School of Technology and member of the research staff of Scientific Control Laboratories, Chicago, Ill. Mr. Modjeska spoke on "The Production of Printed Circuits, Transistors, and Solar Batteries by Electrodeposition." He cautioned the assembled West Coast platers to realize that in printed circuitry plating, rules and regulations given in the handbooks cannot always be followed as "gospel," but the plater must consider the density of metal as he deposits it. Another factor which Mr. Modjeska warned about is that in electroplating printed circuits, if the grain structure is wrong, localized hot-spots are apt to occur.

The high interest developed in the subjects was evidenced by the spirited question-and-answer periods which followed the conclusion of each talk. Mr. Johnson and Mr. Modjeska were kept pinned to the microphone for nearly an hour each, answering question after question from interested platers and chemists.

The final offering on the technical program was a report prepared by *Ezra H. Blount* of Cincinnati, O., editor of *Products Finishing*, in which he described plating and polishing methods as seen by him on a recent trip to Japan. The report was richly illustrated with slides as well as motion pictures of interiors and exteriors of job plating shops in Tokyo and other Japanese centers, plus some travel scenes showing life in urban and rural Japan.

Illness of a member of his family prevented Mr. Blount from attending the Los Angeles session personally. However, his proxy, *Stuart Krentel* of

Kelite Products' Los Angeles staff, did an excellent job in presenting the reports and pictures.

The noon-day luncheon was attended by 160 members and guests. *Frank Virgil* of the L. H. Butcher Co.'s staff served as toastmaster over the distribution of some 60 to 70 trade and industry door prizes, as well as over the Story Telling Contest which annually features this part of Los Angeles Branch's educational session.

The news here was the "dethronement" of *Carrol McLaren* as the champion story-teller of Los Angeles A.E.S. Branch. Carroll had won the title three successive years (1953-54-55), and what could be more appropriate than to have an Irishman named McLaren knocked loose from his title by another Irishman named *Larry O'Neill* on St. Patrick's Day with a story about an Irish judge trying to blarney a chambermaid named Bridget—and not getting away with it.

A reception was held in the Statler Assembly Room from 6:30 to 7:30 p.m. The dinner dance began at 7:30 p.m., setting a new attendance record for the branch with an attendance of 670 ladies and gentlemen. An excellent floor show, a waltz contest, drawing for several hundred beautiful door prizes, and dancing to well beyond the witching hour comprised the program.

James Sowell served as general chairman in arranging this year's affair. His committee personnel was as follows: Educational, *Norman K. McKewan*; reservations, *L. Truman Stoner*, *Harold Boyd* and *George Magurean*; door prizes, *C. P. Simon*, *Warren Davis*, *William Heinicke* and *L. M. Henderson*; Registration, *Frank Virgil* and *David Seymour*; entertainment, *Harold Wanamaker* and *William Thomas*; publicity, and printing, *Kenneth C. Johnson*, *Fred A. Herr*, and *G. Stuart Krentel*.

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A new 16mm. sound and color motion picture, "Zinc Controls Corrosion," tells how zinc in its role of "protector" controls corrosion to lengthen life, and to minimize maintenance and replacement costs.

The new 16mm. film, which has a running time of about 35 minutes, presents a colorful demonstration of the general mechanism of corrosion as well as how zinc controls it. It gives pictorial evidence that a sound corrosion-prevention program based on the use of zinc will lengthen the life of steel products, markedly reduce maintenance costs, and increase net earnings.

Through lavish use of animation and color, the film shows how zinc functions to control the corrosion of iron and steel by acting as a barrier and by affording galvanic protection. It then explains methods for coating steel stock or products with zinc, and surveys the various fields of usefulness for zinc-coated parts.

The film describes new continuous galvanizing lines, the hot dip galvanizing of large structural parts, and such effective means of corrosion prevention with zinc as cathodic protection, metallizing, sherardizing, and painting.

Bookings are now being accepted at the above address. The new film is available for showing at no charge. Special booking forms can be had on request.

AMERICAN SOCIETY FOR TESTING MATERIALS

At Committee Week (Feb. 27-March 2) in Buffalo, the Advisory Committee on Corrosion decided to establish another exposure site in the New York area because of the proximity of a heliport on the roof of the Port Authority Building, the present site. The new location will be on the grounds of the U. S. Steel Supply Division in Newark, N. J.

The Key West test site has been vandalized to the extent that discontinuance has been found necessary. In connection with this area there has been some controversy over the years

as to whether or not this should be typed as a strictly marine atmosphere. As a result, a report has been prepared which will appear in an early issue of the *A.S.T.M. Bulletin* reclassifying the Key West site from "marine" to "rural (marine)."

One of the newer committees represented on the Advisory Committee on Corrosion has already made preliminary plans to evaluate the corrosion resistance of malleable and cast irons. It is hoped that this program will reach the exposure stage sometime in the fall of this year.

ASTM to Hold Extensive Technical Program and Apparatus Exhibit at its 59th Annual Meeting, Atlantic City, June 17-22, 1956

A variety of subjects relating to research and testing of engineering materials will be discussed at the 59th Annual Meeting of the American Society for Testing Materials to be held at Chalfonte-Haddon Hall, Atlantic City, N. J., June 17-22, 1956. A total of 31 sessions are now scheduled beginning on Monday morning and continuing until Friday noon. Eight symposiums are scheduled, plus sessions at which individual papers will be given.

The Marburg Lecture this year will be given by *Dr. Charles E. Reed*, general manager, Silicone Products Dept., General Electric Co., Waterford, N. Y., on "The Chemical Properties, and Applications of Silicones." *Dr. D. K. Crampton*, director of development,

Chase Brass and Copper Co., Waterbury, Conn. will give the Gillett Memorial Lecture on "Structural Chemistry and Metallurgy of Copper."

The Society's 12th Exhibit of Testing and Scientific Apparatus and Laboratory Supplies will be an outstanding attraction. At this Exhibit, held every other year, the latest in research and testing apparatus will be displayed by the country's leading manufacturers. Hundreds of items from small hand-manipulated instruments through electronic control devices and high temperature ovens to universal testing machines will be exhibited.

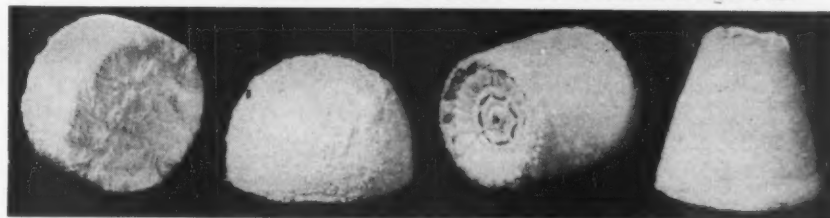
Important in the Society's activities are the large number of technical committee meetings which are scheduled. About 50 committees and their sub-committees will hold a total of about 500 meetings.

The President's address, the introduction of new officers, recognition of 40- and 50- year members, and Awards of Merit will be made at a luncheon session at noon on Tuesday June 19.

On Wednesday evening, June 20, the annual dinner will provide a "break" in a week otherwise devoted to intensive technical activity. Entertainment will be provided after the dinner by the Philadelphia District Council, host for the meeting. The Council is also planning an attractive program of ladies entertainment for the many wives who will accompany their husbands to Atlantic City.

Anyone interested in the subjects being presented at the meeting or in the exhibit will be welcome to attend.

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- 1—U. S. electric double 5 H.P. individual spindle lathe.
- 1—L'Hommedieu, Model 24, 1 H.P. vari speed scratch brush lathe.
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- 1—Two barrel cyanide mechanical plating barrel unit, 14 x 36 cylinder — Crown.
- 2—Globe motor drive Deburring Barrels. Filters — 1000 gallon industrial Filter Type RDR, 300 gallon Belke Acid Filter.
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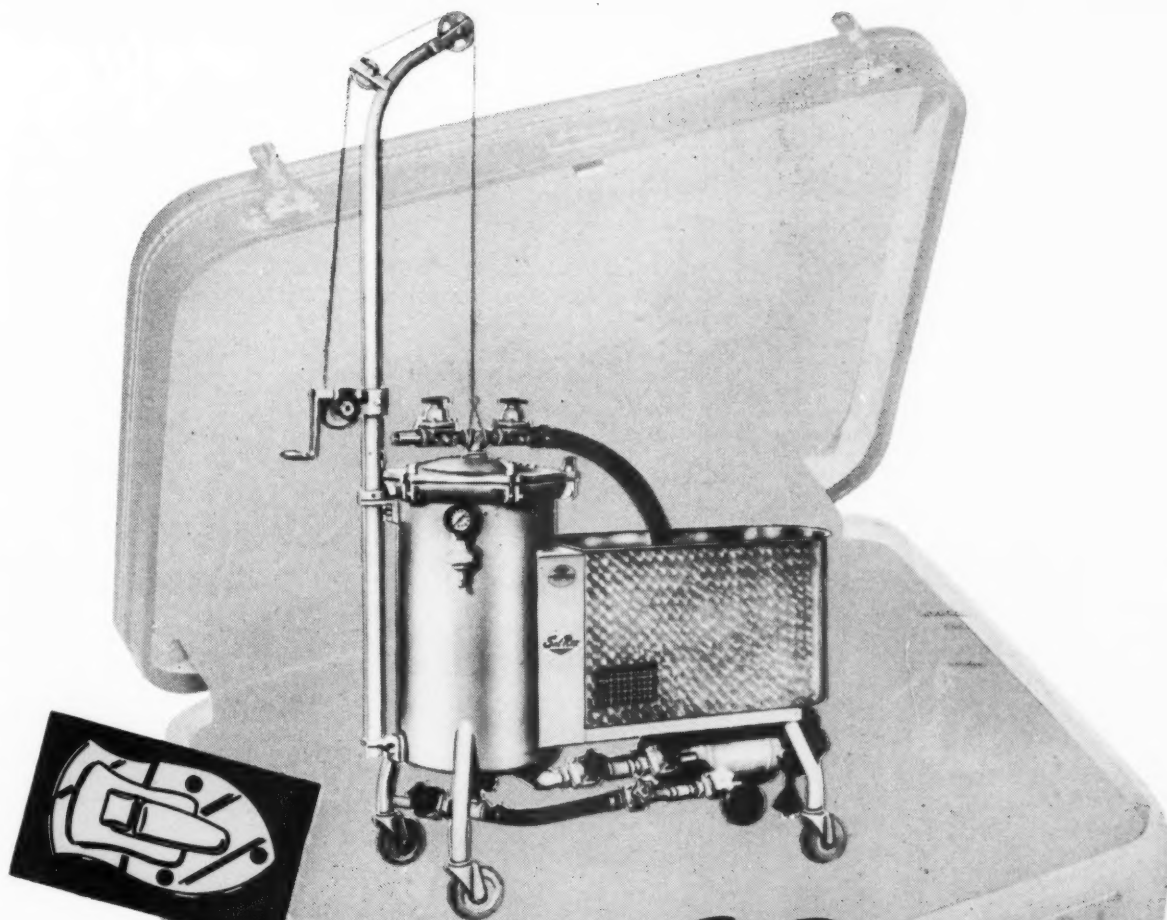
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